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OFFICIAL PUBLICATION

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JUNE 1961

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FEATURE

NEWS

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How *Imaginative Engineering* Pu

Taming Chicago's

John Dolio (right) in front of Powers Graph-O-Matic Control Panel with E. S. Anderson, engineer for the Illinois Psychiatric Institute.

The unusual temperature requirements specified for the new Illinois Psychiatric Institute presented an extraordinary challenge for John Dolio & Associates. This Chicago engineering firm was asked to provide an absolutely uniform temperature throughout the 11-story, T-shaped building. Because temperature variations cause extreme discomfort—even pain—to mental patients, the system had to be accurate, foolproof and automatic. Because Chicago temperatures rise or fall to extremes within hours—sometimes minutes—the system had to be capable of sensing the changing weather picture outside and automatically and simultaneously reacting inside.

The resulting design provides all the answers . . . in a Powers pneumatic control system that operates automatically 24 hours a day—every day—at a bare minimum of cost; a system that compensates instantly for sudden outdoor temperature changes; a system that can be checked and controlled by one man.

The result is a functional system of control where practical engineering principles were combined by the Dolio firm with a strong helping of ingenuity in order to whip some of the more unusual problems. For example, since chilled water was to circulate through ceiling heating-cooling panels, a safeguard against condensation was necessary. The engineers solved this problem with a series of dew point controls mounted at various locations in the ceilings. Thus, "controls on a control" prevent water temperature from falling to the point at which condensation could occur.

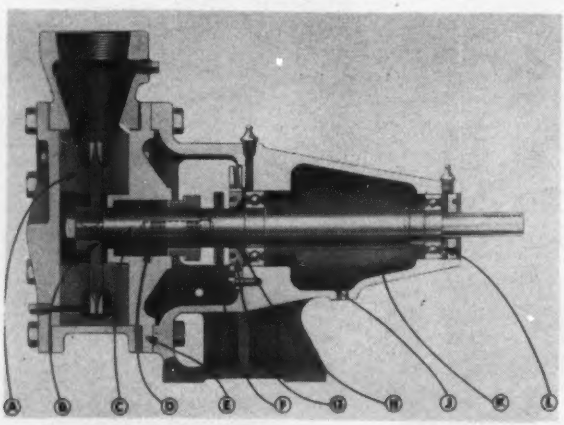
Phil Derrig, Chief Mechanical Engineer of the Dolio firm, inspects one of the dew point controls specially designed to prevent condensation of cold water in the ceiling heating-cooling panels.

PARTS AND PRODUCTS

IMPROVED GENERAL DESIGN PUMP

For boiler feed, condensate return, transfer and circulation applications, this general design pump has the following limits: discharge 150 psig, suction 30 psig, stuffing box 75 psig and temperatures to 210 F. Three advancements in the improved design are renewable liners for fast field repair, heavy stainless steel shaft and drip-proof bearing housing, cited as assuring against bearing failure.

As illustrated are: A, renewable liners; B, rigid impeller mounting squared against shaft shoulder; C, stainless steel shaft; D, mechanical packing adjustable on the job; E, separable liquid end isolated from bearing frame; F, heavy water slinger; G, adjusting collar for positive impeller location; H, layer of water-resistant grease to protect bearings from



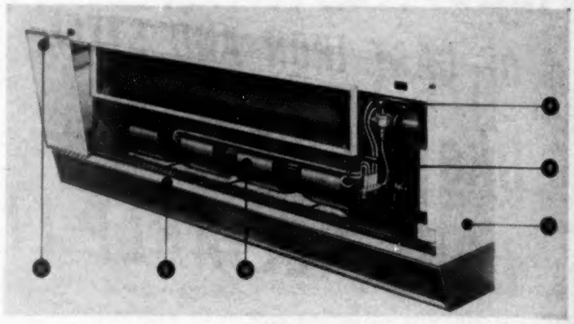
moisture; J, lubricated, factory-sealed ball bearings; K, drip-proof bearing housing; and L, preloading spring to hold diagonal loading on both ball bearings.
Roy E. Roth Company, Turbine Pump Div, Rock Island, Ill.

SCHOOL HEATING, COOLING

Unlike existing units which use modulating control valves to regulate steam or hot water, the School-Vent controls the air, not the water. Included in the system are: a face-and-bypass insulated damper which directs air through and around the heating coil according to comfort requirements; an insulated anti-wipe damper which permits isolation of the coil, eliminating heat pick-up from the coil; and indoor and outdoor dampers which assure proper blend of fresh and recirculated air.

Heating is with steam or hot water and cooling with central-source chilled water. Five sizes up to 1500 cfm heating and cooling are available. Shown in the illustration are: a, pushbutton lubrication system; b, two-speed motor and low-speed centrifugal blower; c, easy-access control panels; d, large end compartments; e, filter that pulls out like a drawer; and f, rugged cabinets.

While classrooms are unoccupied, the School-



Vent heats primarily by convection. Face-and-bypass and anti-wipe dampers are open. Fan starts only when temperature drops below a predetermined setting and cycles briefly a few times nightly. Indoor damper is open, outdoor damper closed for maximum operating economy. Prior to room occupancy, the fan starts and runs until room temperature reaches the daytime setting. Throughout the warm-up, all dampers remain in night-time positions and room air is recirculated for maximum heat gain. With the room occupied and the temperature rising, the outdoor damper opens to blend the proper amount of fresh air with room air. At the same time, the other dampers adjust to maintain the desired room temperature.
Modine Manufacturing Company, 1500 DeKoven Ave., Racine, Wisc.

HUMIDITY CONTROLS

Offered for control of humidifier and dehumidifier units in air conditioning systems, a pair of compact humidistats, J10 and J11, respond to atmospheric moisture content within a confined area to cycle such equipment automatically. Both controls operate within a 20 to 80% relative humidity range. To insure maximum flexibility of installation, the units vary in the positioning of their dial shafts. The J10 shaft is centered between the mounting holes on the side of the control and the J11 shaft is located at one end of the unit, 90 deg from the mounting surface. Controls feature adaptability to line voltage or pilot duty usage. A snap-acting switch, of low force and short stroke, is encased against dirt.
Ranco, Inc., 601 W. Fifth Ave., Columbus 1, Ohio.

CAST ALUMINUM VENTS

Brick Size Vents are now available in an expanded line of 18 modular sizes, fixed and operating, for a wide variety of applications. Units will fit into an exterior wall module in standard and large brick, cinder and concrete block construction. Excellent for use as air intake or exhaust for unit air conditioners, the vents are suited also to ventilation of roof spaces, boiler rooms, crawl spaces, hung ceilings, bathrooms or kitchens. Two fuel oil vents, furnished with standard pipe threading for two and three-in. vent pipe connection, have been designed for use as ventilators for fuel oil and volatile storage tanks. Special finishes

a new and better way to

CLEAN AIR

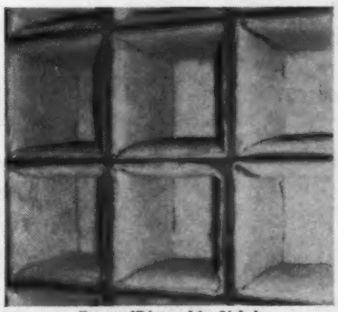
ULOK® Air Filters

Union Carbide research has produced the truly ideal strong, high-capacity filter medium with an irregular, highly-arresting cross section—DYNEL® modacrylic fiber! No other filter medium can touch it for stopping *and holding* unusually large quantities of dust and foreign matter. This dry, un-oiled filter can be vacuum cleaned several times to extend service life even further, if desired.

Proved in scores of major installations—in both new and modified systems—ULOK Air Filters are available in a variety of forms to suit any application.

The Remarkable ULOK Cube-Type Air Filter

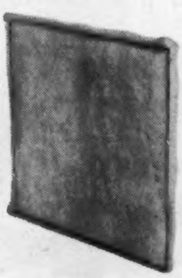
Shaped like an open-top box with slightly tapered sides, the ULOK Cube-Type Air Filter with *five filtering surfaces* represents the most efficient filter shape yet perfected. In operation, air flow first carries the dirt particles to the back face of the filter. As dirt collects on the back face, and air resistance increases, air flow is shunted to the four sides, assuring uninterrupted filtration. In addition, the ULOK Cube-Type Air Filter provides far greater filtering surface than conventional filters with equivalent face dimensions ... and the unique design of the wire basket-type retainers and batt edge assures a tight, leak-proof, press fit.



Front (Dirty Air Side) View of Typical Bank

Rear (Clean Air Side) View of Typical Bank

Advantages: **• Up to 600% longer service life over other throw-away filters due to higher dust-holding capacity • 22% to 28% National Bureau of Standards atmospheric discoloration efficiency • Easier installation—filter is light in weight; no sharp edges or "splinters" to hurt hands • Lower labor and maintenance costs; lower inventories because fewer changes are required • Easier disposal—simply collapse and discard—leaving dirt *in the bag* • 14 different sizes suitable for all new, and many existing installations • Only $7 to $13 per 1000 CFM of air covers total costs (except labor).**



ULOK Panel-Type Air Filters

Patented method of media formation provides a low-density, three-dimensional batt of high capacity DYNEL modacrylic fiber. Entire face and depth of filter traps dirt particles as inherent strength of medium permits elimination of face supports. Modern ring support provides sure-seal edge and eliminates problem of filter by-pass. Particularly suitable for slide-in applications, and all flat or V-bank installations not adaptable to the Cube-Type Filter. Available in 1" and 2" thicknesses, in 9 different sizes, from 10" x 20" to 24" x 24".

For special applications: ULOK filter media is also available in 2" Pads, 58" x 60"... in ½" Rolls, 58" x 25 yards ... and in 1" Rolls, 58" x 15 yards.

For complete information on ULOK Air Filters, including efficiency and pressure-drop charts, write for new bulletins.

UNION CARBIDE

UNION CARBIDE DEVELOPMENT COMPANY
Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

ULOK, DYNEL, and UNION CARBIDE are registered trade marks of Union Carbide Corporation

are available, as are duct extensions, grilles and registers. All vents are supplied with aluminum wire screening.
Construction Specialties, Inc., 55 Winans Ave., Cranford, N. J.

AIR-COOLED CONDENSERS

For use with Refrigerants 12, 22 or 500, these heavy-duty, air-cooled, Aircon condensers (with horizontal or vertical air flow for air conditioning or refrigeration) are available in 19 sizes from 7½ to 100 ton nominal capacity in a single unit. Automatic head pressure control for year-round operation is available

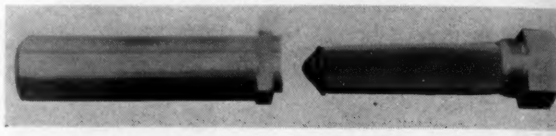
with the Seasontrol or Dampertrol method (with opposed blade face dampers).
McQuay, Inc., 1600 Broadway St. N.E., Minneapolis 13, Minn.

HORIZONTAL ELECTRIC FURNACE

Comprising the FlexAire furnace are two separate sections, a blower and an electric heating section, which fasten together easily. The entire unit can be installed in an attic or suspended from a basement or utility room ceiling. Heating sections provide 10, 15 or 20 kw of resistance heat, operating in 5-kw stages. Total capacity in Btu/hr ranges from 34,100 to 68,300. Operating either on single or three-phase current, the furnace features factory-wired automatic controls in an accessible control box in the blower section. A wall-mounted thermostat is available as an accessory and has a cooling stage for the eventual addition of air conditioning.
Fedders Corporation, 58-01 Grand Ave., Maspeth 78, New York.

CONICAL PLEATED FILTERS

Advantages of reduced pressure drop and improved distribution of flow with minimum package size are combined in a new conical pleated filter element. As flow passes within the filter housing, it is diverted by the streamlined nose piece and flows smoothly through the conical element. Flow area outside the element decreases as the flow inside the element increases, equalizing the flow pattern through the element. Reinforcing is provided to withstand full system pres-



sure. Unitized plug assembly is spun over to effect a seal without the additional weight of a separate threaded plug and O-ring assembly.
Microporous Filter Div, 1537 Embassy St., Anaheim, Calif.

RECORDER

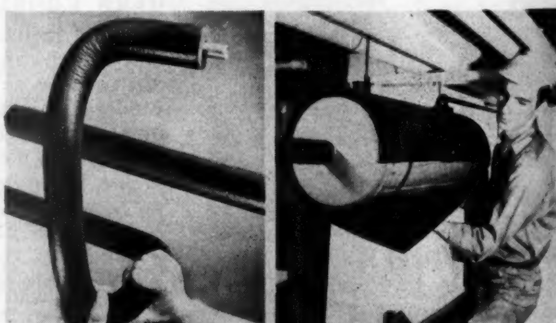
Having fully transistorized circuitry, positive drive action, a built-in voltmeter and a direct reading range dial, this compact recorder is a noise-free, magnetic, flowmeter ac potentiometer. Built on a single removable chassis, the unit has amplifiers, pre-amplifiers and a range network mounted on plug-in cards. Featured are automatic quadrature rejection, easy access to controls, positive "on" indication and a built-in dash-pot.
Fischer & Porter Company, 862 Jacksonville Rd., Warminster, Pa.

SEVEN AIR HANDLERS

Capacities in the AH-Series range from 2000 to 15,000 cfm; all units have a fan and a coil-filter section and are designed for either horizontal or vertical floor installation. Coil section can be turned end-for-end in the field or mounted horizontally adjacent to the fan section. All coils, either direct expansion or water, may be removed on the job or can be installed after the unit is in place. Tapped openings for venting water coil headers are provided. Filters are removable from either end of the units and a choice of permanent or removable type is available.
Chrysler Corporation, Airtemp Div, P. O. Box 1037, Dayton 1, Ohio.

PIPE INSULATION

Added to this pipe covering line, Ultra-Foam, a flexible, foamed plastics pipe insulation, is available in



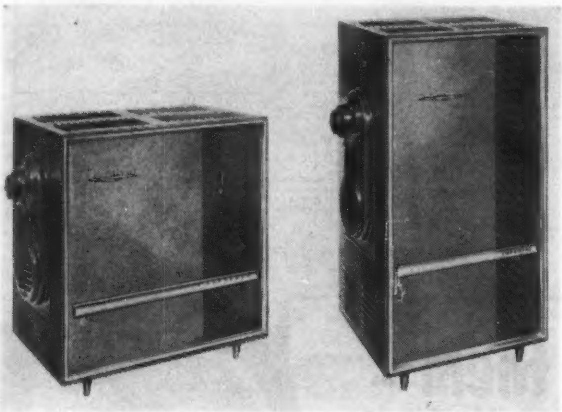
tube or sheet form. Use is for insulation of liquid cooling and heating lines from sub-zero to 220 F in

heating, air conditioning and refrigeration applications. Closed cellular structure of the material is cited as giving it a K factor of 0.28 at 75 F mean temperature and a water vapor transmission rating of less than 0.1 perm.

Tubular Ultra-Foam can be slipped over new piping prior to installation or slit longitudinally and snapped over existing piping. Sheets may be fabricated into pipe covering for sizes over three in. IPS. In tube form, the material is manufactured in six-in. lengths, diam from ⅜ to 3½ in. and in three wall thicknesses. In sheet form, the insulation measures 30 x 36 in., in thicknesses from ⅛ to ¾ in.
Gustin-Bacon Manufacturing Company, 210 W. 10th St., Kansas City, Mo.

OIL HOME HEATERS

Included in the Duo-Therm line are heaters from 41,500 to 75,000-Btu/hr capacities and a 60,000-Btu/hr wall furnace. Models offered are the Contempo (34 x



33 x 29½ in.), Imperial (25 in. wide x 29½ in. deep), Commander (42¼ x 20⅞ x 27¾ in.) and the Royal. Optional accessories are a Power-Air blower, Power-Jet burner and electric or mechanical thermostats.
Motor Wheel Corporation, LaGrange, Ind.

MOTOR STARTERS

Offered in seven sizes, 00 through 5, Bulletin 709 across-the-line motor starters have maximum ratings from 1½ hp, 220 volt and 2 hp, 440-550 volt up to 100 hp, 220 volt and 200 hp, 440-550 volt. Featured are double-break contacts of cadmium oxide silver, reduction of friction in the movable contact support, totally-enclosed arc chambers and use of a magnet, which has the cited advantage of two working pole faces. All three-phase starters are equipped with two overload relays, but can be factory-furnished with three relays. Hold-in contacts are molded into the coil cover.
Allen-Bradley Company, 136 W. Greenfield Ave., Milwaukee 4, Wisc.

AUTOMOBILE CONDITIONER

Suitable for use in both compact and standard-sized cars, the Automatic Auto Air Conditioner has a three-ton compressor and a miniaturized cooling coil designed for fast pulldown to low temperature operating conditions. Outer controls, smaller than in previous models, give more exact variations in cooling. Five fully rotatable and tiltable nozzles, three in front and two on the side for floor cooling, are cited as eliminating hot spots.
Automatic Radio Manufacturing Company, Inc., Boston, Mass.

HEATING ELEMENTS

Tubular defrost heating elements for commercial and domestic refrigeration installations where frost accumulations must be removed periodically also may be used on railroad refrigerated cars, refrigerated trucks, for melting snow accumulation on roofs and for de-icing gutters.

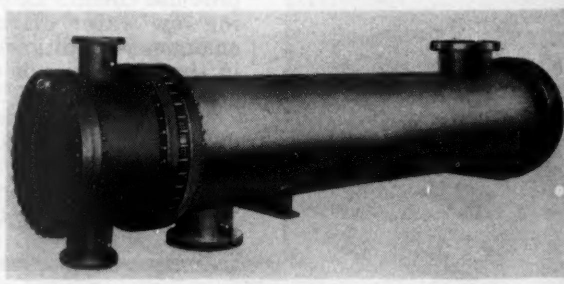
Activated by clock or a door-opening mechanism in refrigerators, the heaters are thermostatically controlled in refrigerated railroad cars. Units usually are sheathed in aluminum, but also are offered in nickel alloy, stainless steel, brass and copper. All are equipped with molded Neoprene sealed ends to keep out moisture.
Heatrex, Inc., 1292 S. Main St., Meadville, Pa.

RETURN AIR GRILLE

Held in the frame of a newly-developed return air grille is a one-in. filter cited as performing the same task as a furnace-installed filter and simplifying filter replacement. Comprising the unit is a grid-type grille, hinged to a flush frame that holds the filter. A sliding clamp locks the filter in when the grille is swung open. Frets set at a 22-deg angle conceal the filter. Eighteen sizes are offered, from 12 x 24 to 30 x 20 in.
Air Control Products, Inc., Coopersville, Mich.

HEAT EXCHANGER LINE

Featuring removable bundles with floating head clamp-ring design, the C-500 heat exchanger series is suited for applications where frequent cleaning of the tubes is necessary or where thermal differential expansion between the shell and tubes becomes a



problem. Cited as handling any combination of liquids and gases, including those which are toxic, volatile or flammable, these exchangers may be used as heaters, coolers, condensers or vaporizers.

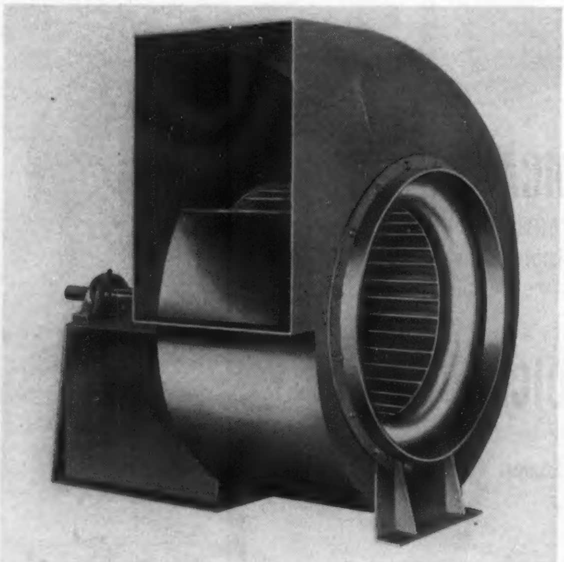
Units are available in nineteen shell sizes from 6 through 42 in. and with any practical tube length in two, four or six-tube pass arrangements. Shell-side

and tubeside design pressures range from 75 to 300 psi. Design temperatures up to 650 F are permissible with carbon steel construction, depending on operating conditions.

Available tubesheet materials include steel, rolled naval brass and types 304 or 316 stainless clad steel. Channels are steel or cast iron, depending on design pressure. Floating head covers and bonnets are available in steel and 304 or 316 stainless steel.
American-Standard, Industrial Div, Detroit 32, Mich.

FORWARD CURVED FANS

Suited for systems having limited space or low noise level requirements, a new line of forward curved centrifugal fans for heavy duty industrial service has



been introduced. Two basic models are offered for a variety of ventilating and high temperature applications: FF Industrial Fans for 300 F max operating temperature, and Thermal-Aire Fans for handling hot air or gases to 2000 F. Thermal-Aire Plug Units are designed for direct installation in furnaces, ovens, kilns and dryers, without external ductwork.

Of heavy-gauge welded construction, FF fans are offered in a range of standard wheel sizes from 7½ to 73 in. diam, with all standard arrangements for belt-drive or direct connection. For applications with special requirements, gas-tight, corrosion-resistant or spark-resistant models are available. Optional accessories include discharge dampers, outlet and inlet flanges, access doors and drain connections.
Garden City Fan & Blower Company, 801 N. Eighth St., Niles, Mich.

OIL-FIRED BOILERS

Packaged, steel, residential, oil-fired boilers for hydronic systems, the PV Series, are available in six sizes from 74,000 to 149,000 Btu/hr. Shipped assembled and factory pre-wired, they are offered with standard or extended jacket and with a domestic hot water heating coil. Adding to heating efficiency of the units is a special design, with the waterleg surrounding the entire firebox and reaching the base on all sides. All controls and the burner are located at the front of the unit. Top outlet smokebox can be removed quickly to expose all fire tubes for cleaning.
Spencer Heater, Lycoming Div, AVCO Corporation, Williamsport, Pa.

ROOF-TOP HEATING, COOLING

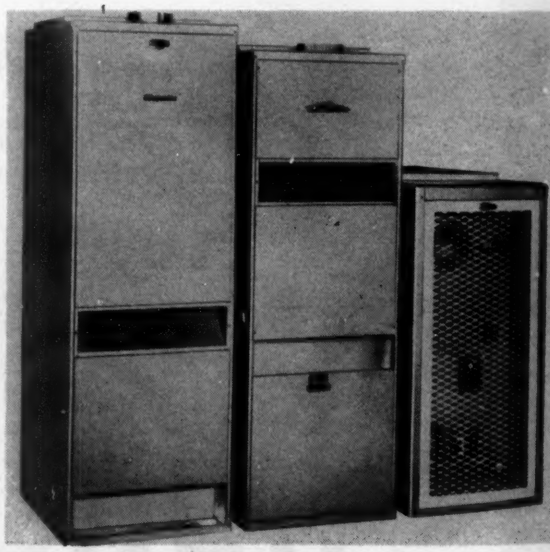
Suited for both commercial or industrial installations, this 7½-hp unit, Model CRU-801, has a total cooling capacity of 75,900 Btu/hr; total output of the gas furnaces is 160,000 Btu/hr. To facilitate adaptability to various types of installations, the unit is divided into two separate sections, one for heating and the other for cooling. Each is prewired, mounted on a four-in. channel iron frame and enclosed in aluminum panels.

Comprising the heating section are two fans on a common shaft, a one-hp fan motor and variable pitch drive, filters and two 100,000-Btu/hr input duct-type furnaces; the cooling section consists of an air-cooled condensing unit, evaporator coil and control box. Supply and return air enter through a single ceiling diffuser.
Westinghouse Electric Corporation, Air Conditioning Div, Staunton, Va.

FOURTEEN FURNACES

Comprising the Starline series of residential and commercial warm air heating equipment are fourteen newly designed gas and oil furnaces. Both upflow and downflow models are included. Eight gas models are produced in four sizes ranging from 72,000 to 140,000-Btu/hr output. Six oil models are in sizes from 85,000 to 135,000-Btu/hr output.

Featured are addition of a round burner pouch on three sizes of the gas units, a new inspection door that affords a better view of combustion chambers



and burner nozzles and enlarged, full-capacity blowers that handle three, four and five-ton air conditioning.
Majestic Company, Huntington, Ind.

News highlights of the month

TRENDS

De-salting sea water

Technical details of the operation of full-scale equipment for low-cost de-salting of sea water on a commercial basis have been revealed by Fairbanks Whitney Corporation. Now on test in preparation for quantity production, the equipment was developed in a joint venture with the Government of Israel. According to the firm, test data have shown that the unit will produce water at less than $1 per thousand gal for a plant of one million gal a day, said to be the lowest cost achieved by commercial equipment.

Cornell grant

Ford Foundation has provided a grant of $4,350,000 to Cornell University to further strengthen graduate study and research in the College of Engineering. It is announced that this grant will contribute toward the endowment of eleven professorships and will also make possible substantial graduate fellowships and loan assistance, additional facilities for study and research and will make other funds available for special purposes.

API research

American Petroleum Institute has selected five organizations to work on principal projects of a special oil burner research program, according to A. J. Rumoshosky, Director of the Institute's Marketing Div. Research groups and projects, to be started within 30 days, are: Armour Research Foundation, air-fuel mixing and recirculation; Arthur D. Little, Inc., new means for fuel atomization; Atlantic Research Corp., ways to minimize deposits during vaporization of No. 2 heating oil; Battelle Memorial Institute, more suitable ignition systems, air compressors and fuel pumps for small oil burners; and Stanford Research Institute, effects of spray-droplet size on combustion.

Technicians certified

National Society of Professional Engineers has authorized the establishment of an Institute for the Certification of Engineering Technicians. An examining and certifying body only, the Institute will determine qualifications for three classes of technician upon voluntary submission of credentials by a person seeking such recognition. Persons practicing engineering are excluded from consideration since matters in the professional realm fall under the jurisdiction of the various state boards of engineering examiners.

Scholarship

Henry Torrance (ASRE Past President, 1914) has established a scholarship fund at Stevens Institute of Technology to encourage promising young high school students of limited financial means to prepare to enter and complete the prescribed course at Stevens. Mr. Torrance celebrated his 92nd birthday on March 7.

New curriculum

Rensselaer Polytechnic Institute has established an engineering science curriculum, to be effective in September. According to Dr. V. Lawrence Parsegian, Dean of the School of Engineering, the new program should be of special interest to students who wish to prepare for graduate study and for research following patterns that may be unconventional.

French society

Nine French associations and groups totaling approximately 5500 members have established the "Societe Francaise des Thermiciens" for the purpose of publication and promulgation of knowledge relating to the field of temperature. Meeting for the first time on December 12, 1960, the Council of Administration of the society elected Professor Marcel Veron as president.

BOOK REVIEWS

Professional climate in engineering

Included within the Proceedings of the College–Industry Conference on Professional Climate in Engineering, sponsored by the Relations with Industry Div of the American Society for Engineering Education and the University of Cincinnati, are twelve papers presented at this meeting, held in Cincinnati, February 2-3. Copies of the Proceedings may be obtained from the College of Engineering, University of Cincinnati; price is $5.

Estimating labor

Estimator's Heating, Plumbing and Air-Conditioning Manhour Manual by John S. Page contains numerous manhour tables with easy-to-use listings which serve as guides for estimating manhours in every phase of plumbing and mechanical work. Compiled from extensive studies, the tables include

actual labor costs on many projects. Gulf Publishing Company, P. O. Box 2608, Houston 1, Tex.

Air pollution

Now available, a new OTS Selective Bibliography, SB-448, "Air Pollution and Purification," lists 124 U.S. Government research reports and translations of foreign literature on air pollution by nonradioactive fumes, industrial gases, smoke, aerosols and other contaminants. Subject categories include problems and effects of air pollution; studies in levels of pollution; and methods and equipment for air purification. Published by the Office of Technical Services, Business and Defense Services Administration, U. S. Department of Commerce, Washington 25, D. C.; price is 10 cents.

ARI Directory

Containing certified ratings on more than 2700 units of 53 manufacturers participating in the Unitary Air-Conditioner Certification Program sponsored by the Unitary Air Conditioner Section of the Air-Conditioning and Refrigeration Institute, a new edition of the Directory of Certified Unitary Air Conditioners, second in 1961, has been released by ARI. Copies of the new Directory, which supersedes all previous editions and is effective through July 31, are available from ARI, 1346 Connecticut Avenue, N.W., Washington 6, D. C.

TRRF report

"Research on the Refrigeration of Perishable Commodities," Annual Report of the Director – 1960, The Refrigeration Research Foundation, 12 N. Meade Avenue, Colorado Springs, Colo., describes the fourteen studies which are being sponsored in the current research program, together with lists of completed studies, publications, grants-in-aid and officers.

For draftsmen

With special emphasis on drawing, *Sheet Metal Drafting* by Melvin L. Betterley covers all phases – techniques, projection principles and descriptive geometry, integrated and applied whenever possible to situations in the sheet metal field. Written to train draftsmen, the book concentrates upon basic principles which can be applied to various situations. McGraw-Hill Book Company, Inc., 330 W. 42nd Street, New York 36, N. Y. 314 pages, $6.50.

Trends in engineering education

Summarizing important changes in engineering education which have taken place during the last ten years, "Trends in Engineering Education, 1949 to 1959," attempts to present such facts as will point up general trends in the national program of engineering education. Published by the Office of Education, U. S. Department of Health, Education and Welfare, this report, OE-56003, Circular No. 635, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.; price is 45 cents.

SPECIAL MEETINGS

Mechanical contractors meet

Held in Miami Beach, Fla., May 9-12, the 72nd annual convention of the Mechanical Contractors Association of America included a session of its Air Conditioning & Refrigeration panel, whose subject was Air Conditioning Coil Freeze-ups. Panel consisted of a mechanical contractor, a manufacturer of coils, a representative from a controls manufacturer and the director of building operations from a real estate firm that supervised commercial and business structures.

Cryogenic Conference

Sponsored by the University of Michigan, the 1961 Cryogenic Engineering Conference will be held in Ann Arbor, Mich., August 15-17. Information regarding this Conference may be obtained from K. D. Timmerhaus, Secretary, 1961 Cryogenic Engineering Conference, Department of Chemical Engineering, University of Colorado, Boulder, Colo.

Air ionization

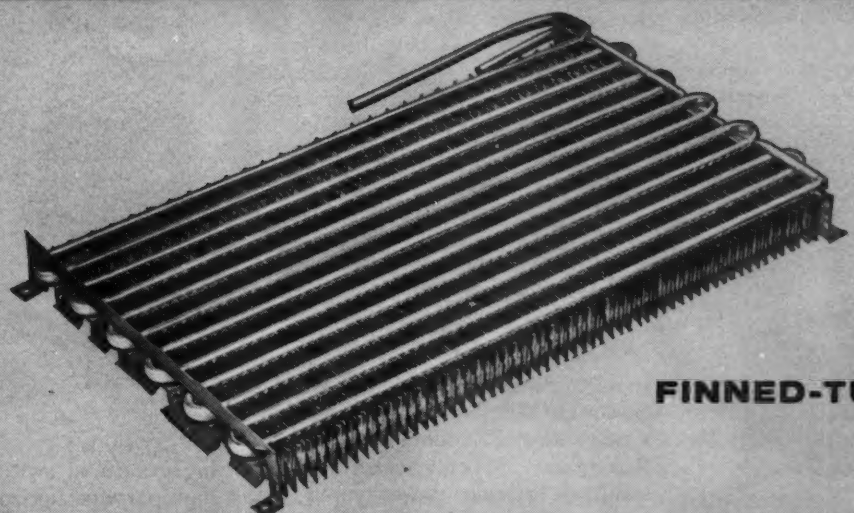
To be sponsored by the American Institute of Medical Climatology, an international conference on ionization of air, scheduled for October 16-17 in Philadelphia, Pa., will feature internationally recognized authorities in the field of air ionization. American Institute of Medical Climatology, 1618 Allengrove Street, Philadelphia 24, Pa.

Heat transfer institute

1961 Heat Transfer and Fluid Mechanics Institute, sponsored by the California Institute of Technology; Stanford University; University of California, Berkeley; University of California, Los Angeles; University of Santa Clara; and University of Southern California, with ASHRAE, AIEE, American Rocket Society, ASME and the Institute of the Aerospace Sciences, will be held at the University of Southern California, Los Angeles 7, Calif., June 19-21, 1961. Some copies of the final program are available from ASHRAE headquarters.

FOR EVAPORATORS

BRAZED TUBING AND SHEET



FINNED-TUBE*

*Reynolds does not fabricate finned-tube evaporators, but does supply raw material for customer fabrication.

more efficiency and quality, too

evaporators; it is equally effective in frost-free refrigerators and air conditioners. Aluminum tubing has always made "design sense" for finned-tube evaporators. It is more *economical* than copper, and it provides excellent heat transfer. Now available with aluminum fins, it eliminates bi-metallic corrosion.

All of these basic evaporator materials have several benefits in common: being aluminum, they have excellent heat transfer characteristics; and they're lightweight and strong. So, no matter what form of Reynolds Aluminum you choose for your evaporator, you can count on its efficiency, and long, trouble-free performance.

For details on aluminum for evaporators or any refrigerator application—and for information on Reynolds styling, design, and fabricating services—call your local Reynolds office. Or write *Reynolds Metals Company, P. O. Box 2346-AP, Richmond 18, Virginia.*

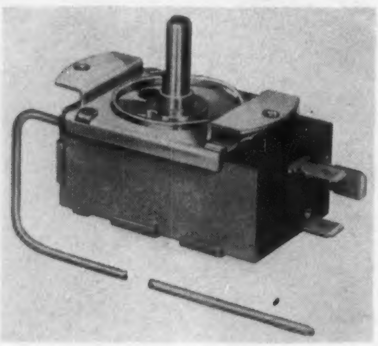
Watch Reynolds TV show "Harrigan & Son", Fridays—ABC-TV.

PARTS AND PRODUCTS

REFRIGERATION CONTROLS

In operation of the A40 refrigeration cycling control, varying temperatures on the power element capillary or bulb change the internal pressure and height of the bellows. This in turn causes a movement within the control mechanism which rotates the toggle lever to operate the switch. The snap-action switch opens on a decrease in temperature. Standard element of the unit is vapor-pressure filled and its bellows respond to the coldest temperature point on the capillary tube or bulb. Operating limits from −24 to 71 F can be provided. Available temperature differentials in the A40 series range from 8 F min to 66 F max.

Incorporated in new thin model A42, constant cut-in control, are the



same extra-wide differentials and side access terminals as in the A40. Frost-free operation is cited as being assured, since the compressor cycles each time the evaporator temperature reaches the control cut-in temperature. Standard power element is limited vapor-pressure charged and operates the control mechanism from the coldest portion of this element. Temperature operating limits from −24 to 71 F are available and temperature differentials vary from 12 F min to 66 F max.

Ranco, Inc., 601 W. Fifth Ave., Columbus 1, Ohio.

LIQUID FLOW SWITCH

Designed for use as a protective device to operate a switch when the flow of a fluid is a critical factor for operating efficiency, this liquid flow switch features low pressure drop, high current capacity and immunity to shock and vibration and utilizes no diaphragms or moving shaft seals. Body construction is bronze, with a Teflon vane. Maximum current capacity is five amp, 250 volt ac. Unit is available in ranges of ½ to 6 gpm.

Henry G. Dietz Company, Inc., 12-16 Astoria Blvd., Long Island City 2, New York.

FURNACE LINE

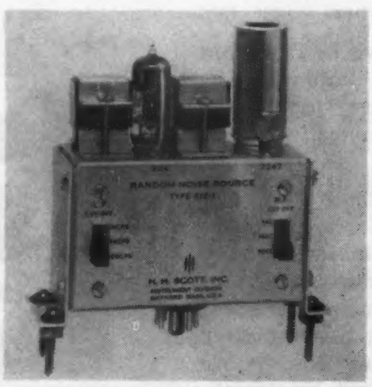
Redesigned, these furnaces (Super-Series) are available in either oil or gas-fired models in Hi-Boy, Lo-Boy or Counterflow styles. The oil line may be converted to gas fuel at any time after installation.

Air passage tubes have been made oval for greater strength. Special dies extrude the heat exchanger sides where the tubes extend through it, producing a streamlined extension. Strengthening embosses have been made wider to give more flexibility to the metal.

Williamson Company, 3500 Madison Rd., Cincinnati 9, Ohio.

NOISE SOURCES

Random "white" noise with Gaussian amplitude distribution is provided by a new series of Random Noise Sources that utilize an octal socket for both standard console power input and random noise output. Use is for approximating electrical signals and disturbances, sounds and vibrations for both general investigations and environmental testing. By use of two three-position frequency cut-off



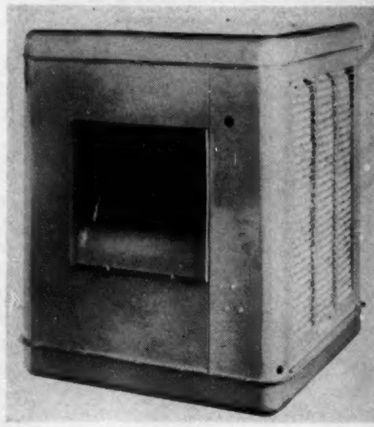
switches, nine selected frequency ranges are available.

Model 812-1 is designed primarily for vibration work and 812-2 is useful for general audio frequency investigations. Special models of the 812 incorporating any three selected lower and upper cut-off frequencies from 3c to 50 kc are available. Series 813 provides output in any single fixed frequency range desired (within 3 c to 50 kc) with a cut-off rate of 6 or 12 db per octave. Produced to order, 814 Noise Sources provide a noise output with shaped spectrum for simulation of specific noise environments.

H. H. Scott, Inc., Instrument Div, 111 Powdermill Rd., Maynard, Mass.

AIR COOLERS

Multipurpose and trailer coolers have been added to this line of evaporative air coolers. Trailer units, available in sizes of 2200 and 3200 cfm, have a factory installed pump and two-speed motor and come complete with ceil-



ing grille and switch assembly. The multipurpose, horizontal discharge air cooler (shown) is suited for commercial and industrial buildings, and is offered in sizes of 2000, 3000, 4000, 4500 and 5500-cfm air delivery. Featured on both series are rubber-cushioned blower shaft bearings, all-plastics recirculation pump and a water distribution system that meters the water flow.

Dearborn Stove Company, 1700 W. Commerce, Dallas 22, Texas.

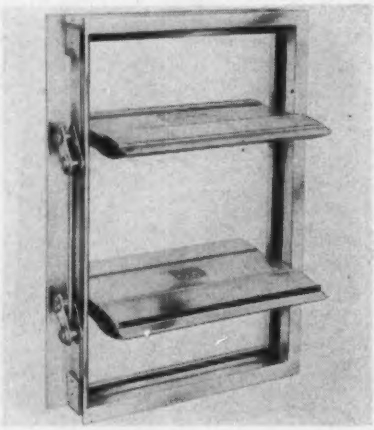
ZONE VALVES

Two new styles are offered: Zone-a-Flow straight-through type, for multiple-pipe systems, and Zone-a-Loop diverting type units, for single-pipe installations. Operating the valve is a specially designed, shaded-pole motor. Motor and gear train are immersed in sound-dampening lubricating fluid and sealed in a metal case. This construction, combined with slow opening and closing of the valve, reduces operating noises both within the valve itself and throughout the system. A new valve stem design is of the barrel-type, made of chrome-plated Monel, and is self-aligning. Also featured is

a visible, automatic recycling manual operator; this is a notched wheel which turns with the stem and shows stem position at all times.
White-Rodgers Company, 9797 Reavis Rd., St. Louis 23, Mo.

ALUMINUM DAMPER

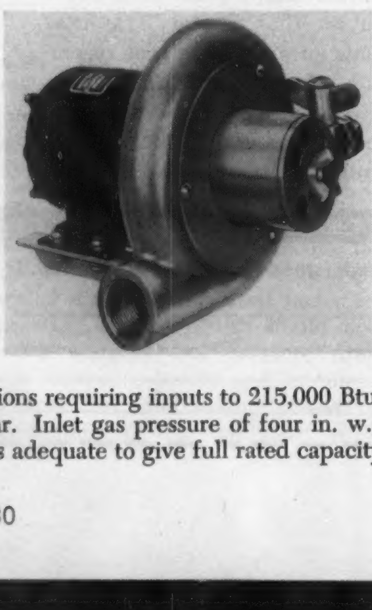
Major improvement in this aluminum damper with airfoil double blade is the elimination of hardware from the blade. Use of vinyl stripping is cited as making the unit more air-tight than its steel counterpart. When closed,



the double blades act as an insulator, and, because the duct size is reduced, there is less friction and turbulence. Blade widths vary from five to nine in.
Arrow Louver & Damper Corporation, 72 Berry St., Brooklyn 11, N. Y.

FAN-TYPE MIXER

Producing an air-gas mixture, the Minimixer delivers it under pressure to a burner or series of burners for small industrial heating applications or installations where a blast pilot is desired and no other source of air pressure is available. Less than 6½ in. diam, this miniature fan-type mixer is designed for firing installa-



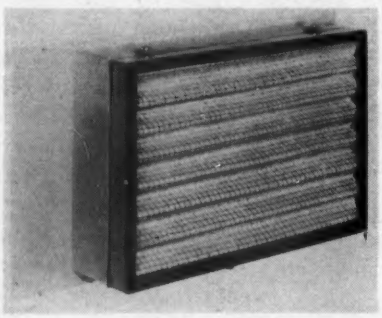
tions requiring inputs to 215,000 Btu/hr. Inlet gas pressure of four in. w.c. is adequate to give full rated capacity. Firing can be at a fixed rate or automatic on-off control can be provided by installing a solenoid valve in the gas line feeding the mixer. Design and construction features of the cast aluminum mixer include: an open-frame 1/25-hp motor, adjustable disc-type shutter and adjustable orifice incorporated in the inlet gas cock for controlling gas input.
Eclipse Fuel Engineering Company, Rockford, Ill.

INSULATION

Available in either Styrofoam or urethane, Vapo-Lock pipe and vessel insulation gives protection under a wide range of operating conditions. Providing a barrier against heat and moisture vapor transmission through the joint is a new tongue and groove joint system.
M M M, Inc., P. O. Box 2114, Houston 1, Texas.

PACKAGED FILTER

Redesign of the Specialaire dust-free cabinet provides a high efficiency, packaged filter unit which may be removed for cleaning and replacement with minimum downtime and contamination. An illuminated chamber, the unit provides a controlled environment for assembly, test, re-



search and repair of miniature precision components and instruments.

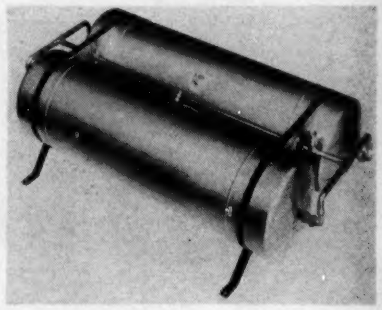
Comprising the filter unit are a two-speed blower and two filters attached to the rear of the cabinet. Supply air first passes through a permanent washable-type filter and then through a high efficiency Aerosolve filter. Pleated design is used in the second-stage filter to increase filtering area and reduce the pressure drop.
Cambridge Filter Products Corporation, 738 Erie Blvd. E., Syracuse 1, New York.

COOLER DOOR

Suitable for installations where multiple-door loading docks are used for truck loading, this horizontal-sliding cooler door has front, back and edges of plywood sheathed with 26-gauge galvanized steel. Polystyrene plastics inside the door provides a high insulating capacity. Flexible gaskets and seals prevent air leaks around top, bottom and sides and steel door wedges provide three-point compression seal. Each door is suspended from wheeled trolleys which run along a steel overhead track. This track is inclined slightly, so that doors will roll automatically to a compression seal. Doors are available with three, four and six-in. insulation.
Jamison Cold Storage Door Company, Hagerstown, Md.

EXPANSION TANK

Ex-Trol, a pressurized, diaphragm-type expansion tank, is now available

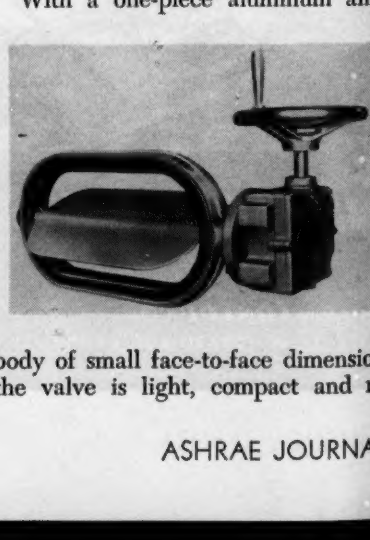


in an increased range of sizes for commercial and industrial installations of hydronic heating. Features of smaller units are retained in the SX Series, including a diaphragm to separate permanent air cushion from system water.
American Tube & Controls, Inc., 100 Pulaski St., West Warwick, R. I.

BUTTERFLY VALVES

Easily adaptable with application of transitional fittings, this line of control and shut-off butterfly valves has been developed for rectangular and flat oval ducts for industrial and process ventilation and air conditioning.

With a one-piece aluminum alloy

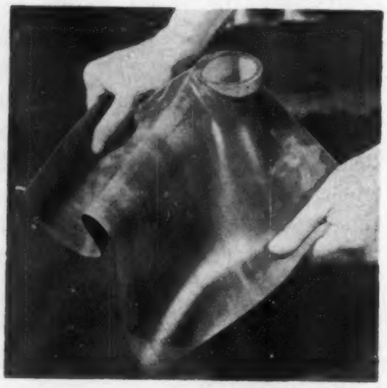


body of small face-to-face dimension, the valve is light, compact and re-

quires minimum installed space. The body has a replaceable rubber or synthetic resilient elastomer liner, against which the oval aluminum disc seats for tight closure. Because of the valve's design, there is minimum pressure drop in full open position of the disc. Throttling and shut-off can be controlled by a lever, hand wheel (as shown) or automatically by a pneumatic cylinder, diaphragm operator or electric motor.
W. S. Rockwell Company, 300 Eliot St., Fairfield, Conn.

PRE-CUT FLASHING

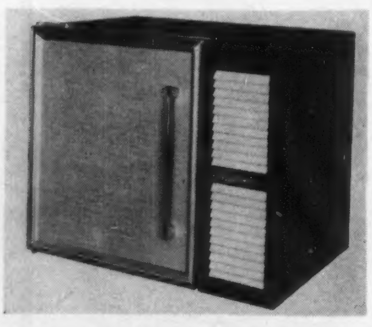
Designed to speed on-the-job application, pre-cut flashing for vent stacks is offered by this manufacturer. Formed of Saraloy 400 flexible flashing, the sheets are made to fit four sizes of pipe: an 18 x 18-in. sheet has



openings for 2½ and 3-in. pipe and a 20 x 20-in. sheet has openings for 3½ and 4-in. pipe. Waterproof, weather-resistant, conformable and fire-resistant, the material has a nominal thickness of 1/16 in.
Dow Chemical Company, Midland, Michigan.

SMALL REFRIGERATOR

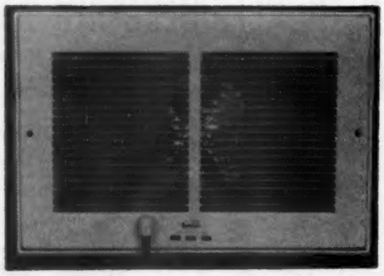
Designed for home and commercial use, the Chill-Air Model PR-6 is an individual room refrigerator available



as a built-in, portable or free-standing unit. Capacity is 2.7 cu ft and the refrigerator is insulated with high density glass fiber. A ⅛-hp, sealed-in-steel compressor is protected against air, moisture and dirt. Moving parts float in a lubricating film.
Erickson Industries, River Falls, Wisc.

CONTROL UNIT

Inserted in a room air vent, the Boostair, a small, thermostatic-control



unit, is cited as assuring uniform and efficient warm air distribution. Use of the unit may also be extended to distribution of cooled air in air conditioned homes.
Rapid-American Corporation, 711 Fifth Ave., New York 22, N. Y.

EVAPORATORS

Two to seven-ton evaporator units for air-cooled air conditioning systems permit a broader range of installation than previous models. Comprising the line are vertical air flow evaporators in two, three, four and five ton; horizontal air flow units in the same sizes; blower equipped evaporators in two, three, four, five and seven-ton; and counter-flow models in two, three and four ton.

Up-flow evaporators are equipped with a separate galvanized, fully insulated bottom pan, the opening of which can be enlarged to fit the outlet of most furnaces. Side panels are provided with knock-out openings for flexibility in location of tubing. Front and rear panels are interchangeable, making it possible to install the coil from either the front or the rear.
American-Standard, Air Conditioning Div, 40 W. 40th St., New York 18, New York.

VENTILATING SYSTEM

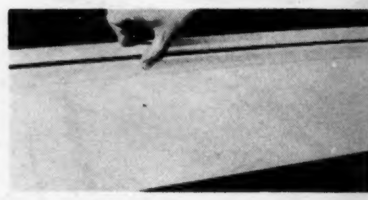
Provided by a single compact unit are recirculation of heated air in winter and exhaust of hot air in summer. During the winter, a Divertco-Damper seals the top of the unit against heat loss and a three-position reversing switch controls the direction of the fan. On the recirculating cycle, the fan blows the air downward. Waste heat trapped under the ceiling is drawn into the fan and blown out diffuser openings at the bottom, carrying it back to the floor area.

On exhaust cycle, during the summer, the fan blows the air upward, drawing hot air into its path and exhausting it outside the building. The damper is lifted up by the air column and seated against the under side of the weather dome.

Model ER (Dual Exhauster-Recirculator) ranges in size from 3000 to 23,000 cfm.
Genie-Air Products, 3001 E. 11th St., Los Angeles, Calif.

HYDRONIC BASEBOARD

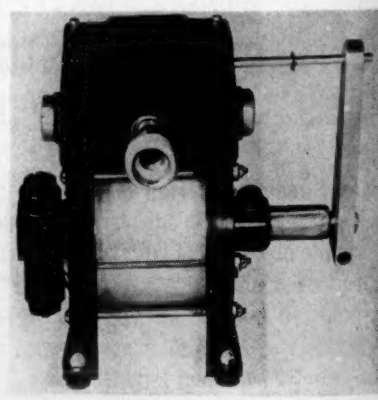
Standard equipment is a built-in damper which snaps into place on hanger brackets, without extra cutting or fitting. Once in place, it may be adjusted to any position from fully open to fully closed without use of knobs or screws. This new baseboard



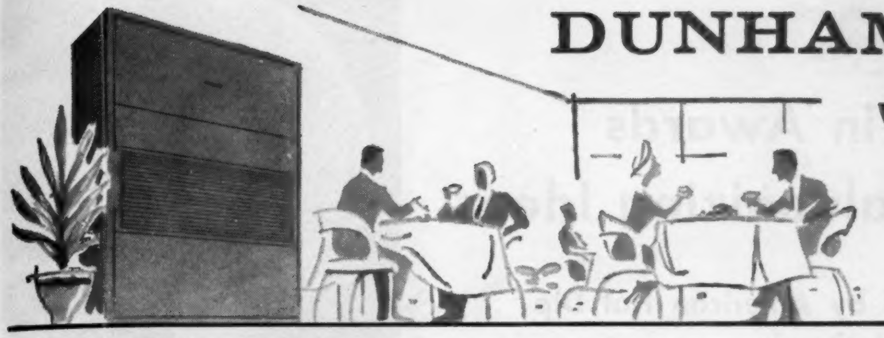
is designated Beautybase Model LD-20U.
Continental Manufacturing Company, P. O. Box 4048, Baltimore 22, Md.

DISPENSER

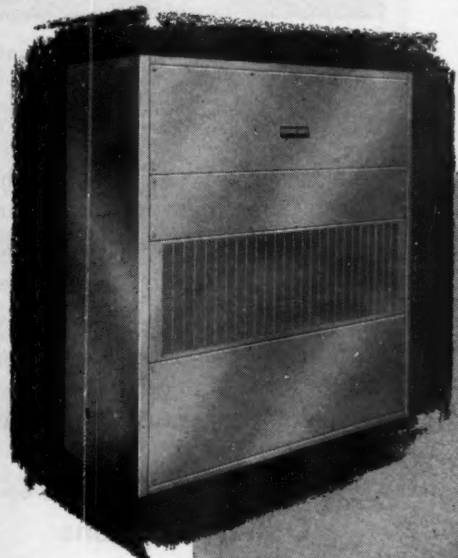
Delivering exact chemical treatments in maintenance of commercial and industrial air conditioning units, the Corvin Proportioner blends any prescribed water-soluble material with water or other liquids at the rate of one oz. per gal, and can treat up to 360 gph. Working on water pressure alone, the unit is hooked easily to



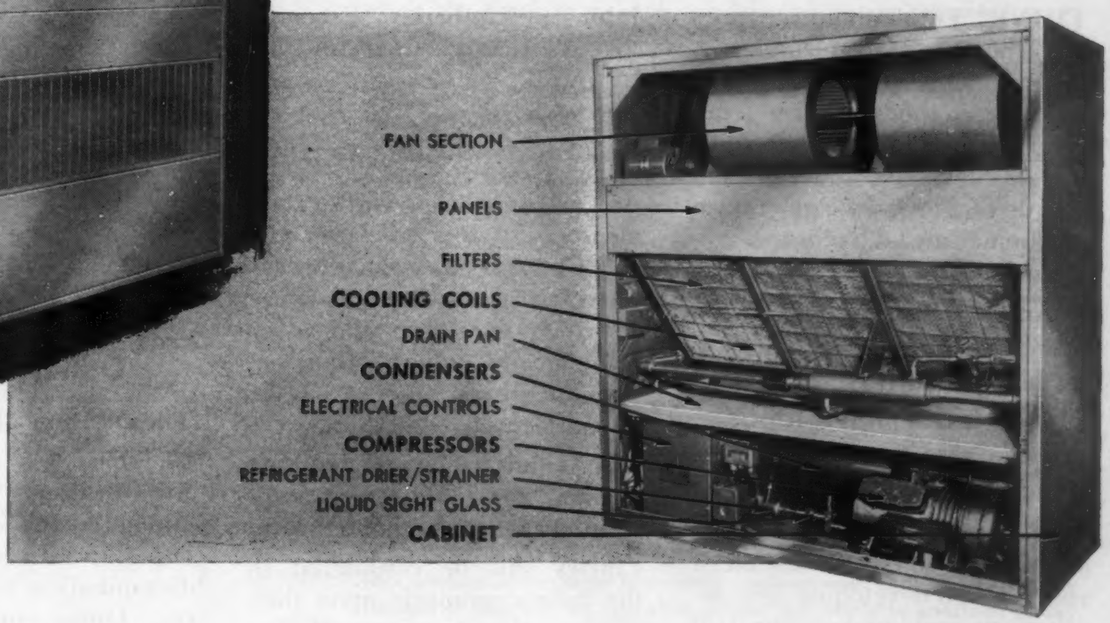
existing water lines with a by-pass arrangement consisting of two standard T fittings, a cut-off valve and two pieces of pipe.
Proportioning Devices Div, Royal Industries, Ltd., 8th & Wood Sts., Vineland, N. J.



DUNHAM-BUSH 'PAC'



Proves how to properly package air conditioning



Important to contractors and specifiers is peak performance of Dunham-Bush "PAC" Packaged Air Conditioners, achieved through pre-engineered major components. Other manufacturers, using components from diverse sources, must attempt to improvise balance. But Dunham-Bush manufactures and designs the motor compressor, condenser, evaporative coils and cabinet specifically for "PAC". This "one source-one responsibility" is evident in dependable operation and customer satisfaction.

"PAC" units are packaged for use, on-premises or remotely installed, in restaurants, stores, offices, clubs, banks, factories, depots or wherever high capacity, self-contained air conditioning units are required. Attractive finish harmonizes with decor practically anywhere.

"PAC" is available in 10, 15, 20, 25 and 30 h.p. capacities with either front or top discharge Air cooled or Water cooled models.

You'll want to have full details. Write today for Bulletin No. 6022 or request a copy from your nearby Dunham-Bush representative.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

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Advertisement by American Hot Dip Galvanizers Association

Galvanizers International Award

$10,000. in Awards for Hot Dip Galvanizing Ideas

Ten awards offered by American Hot Dip Galvanizers Association in cooperation with American Zinc Institute

THINK! Think about new uses for Hot Dip Galvanizing! Or, improvements in present uses! Or, new methods of after treatment! If your idea is accepted, you will receive one of ten awards of $1000 in cash, plus a handsome medal, plus an engrossed Certificate of Achievement.

Not a contest but a search for new ideas

This is not a contest—it is a search for new ideas. Your entry will not be judged against others, but solely on its merit and value in developing new applications and markets for Hot Dip Galvanizing. If your idea, in the opinion of the judges, is of practical value to the industry, you will be cited for an award—promptly.

The Hot Dip Galvanizing Industry is anxious to receive ideas of this type; therefore, the judges reserve the right to present *more than 10 awards,* if the entries warrant.

These well-known men will act as judges

Dr. Clarence H. Lorig, Technical Director, Battelle Memorial Institute and Past President American Society for Metals. Mr. John R. Daesen, Technical Director, American Hot Dip Galvanizers Association. Mr. John L. Kimberley, Executive Vice President, American Zinc Institute.

Anyone is eligible to enter

Anyone in the world (except members of the American Hot Dip Galvanizers Association and the American Zinc Institute, and their employees and advertising agencies) may submit one or more entries.

Business firms or corporations may submit entries under their business name, instead of as individuals, if they choose.

Entries will be considered by the judges promptly upon their receipt. No entry received after April 30, 1962 will be considered.

These are the kind of ideas we're looking for:

The Awards will be made for ideas pertaining to: (a) Applications of Hot Dip Galvanizing to a new or unusual field, or; (b) An improvement in application in fields where Hot Dip Galvanizing is now being used, or; (c) New methods of after-treatment of Hot Dip Galvanized products.

Each entry must contain:

(a) Description and documentation of application.

(b) Case history of the application or process accompanied by photo, drawings, formulae, etc.

(c) All technical data needed for the utilization of the idea submitted.

(d) Release of the application or idea for general use without payment or royalty other than the $1000 award.

Other conditions:

The decision of the judges will be final.

Award-winning ideas will be retained by the American Hot Dip Galvanizers Association for dissemination throughout industry. Other entries will be returned.

No formal entry blank is required. The entry should be accompanied by your name, address and business connection.

Entries should be sent to:

American Hot Dip Galvanizers Association, Inc.
5225 Manning Place, N. W.,
Washington 16, D. C.

Note: For information on galvanizing, write to the above address for name and location of the American Hot Dip Galvanizers Association member nearest you.

JOURNAL
OFFICIAL PUBLICATION

JUNE 1961

Comment

THAT SHOEMAKER'S CHILDREN!

There is a story of sorts going about which has to do with the business executive whose firm recently occupied new premises and where the blissfully new air conditioning system presented some still unsolved problems. Allegedly, he showed up one morning with a canary in a small cage in one hand and a newspaper-wrapped brick in the other to announce, "When that bird keels over, this brick goes through the window!"

Well, apocryphal or not, there is a point. For it is no secret that there are air conditioned installations less than pleasing to some occupants of the overall space; happy though others may be.

Yet there is no mystery, no unknown about this. It is technically possible to provide virtually argument-proof air conditioning throughout new structures. There are but two basic difficulties. First, those at adjacent desks who like to "feel cool" and those who like to "feel warm". That is a stopper, but, even so, is capable of solution. The other is the inescapable fact that engineers either may, in ignorance, not take adequate advantage of known facilities and techniques or, knowing, may be blocked by the dollar mark from providing true adequacy in relation to available know-how.

We suppose there will always be such things. Ignorance and greed remain among the great obstacles to human accomplishment.

As for the uncomfortably warm man and the uncomfortably cool woman in the same immediate environment, capable of solution though it may be, we feel that people are likely to continue to act like people.

There is that more or less classic observation by British statesman Bevan to the effect that "There can be no such thing as Freedom for smokers and non-smokers in the same room". Who is to say this does not apply quite as truly to other matters of environment?

THREE WEEKS TO DENVER

Previewed in this issue, the 68th Annual Meeting of ASHRAE, to be held later this month, represents a sort of triumph in planning and arrangements. So closely do the Semiannual and Annual Meetings follow each other in 1961 that the Program Committee, Meetings Arrangements Committee, JOURNAL Editors and Assistant Secretary for Meetings had some fast work to coordinate their efforts and activities on behalf of attending members and guests.

Nevertheless, we think you will find Denver to be one of ASHRAE's most stimulating, informative, enjoyable and significant meetings.

Have you made your reservation?

Edward R Searles
Editor

Pursue a Long Range Plan

for personnel

HAROLD P. HAYES
Member ASHRAE

Throughout my fifteen years in the field of education, I have developed a deep and lasting affection for the air conditioning and refrigeration industry, and for its people. I would see the industry grow and prosper and its people find satisfaction and success in their work. I propose a long-range plan for its personnel development.

It is my observation that there are at least three basic driving forces which motivate personnel. The diamond ring, the mink coat, the college degree, the professional engineering registration — all are symbols of a drive for **status**. The insurance policy, the bank book, the social security number — these are symbols of the drive for **security**. And, of course, the membership in the professional society, the challenging problem and the desire to contribute to a cause are symbols of the drive for **individual satisfaction**. These three driving forces exist in each of us to varying degrees and in different proportions.

Although we often think in terms of a college preparing men for industry, this point of view is not entirely sound. Colleges do not have as much effect on the basic driving forces as we might like to think; it may even be dangerous for a college to tinker too much with these forces. The high schools tried it in the form of social adjustment courses and, to believe the critics, did so at the expense of subject matter competency. Basically, a college merely makes its students more proficient in satisfying the desires generated by the three driving forces of security, status and individual satisfaction. The graduate carries his own specific combination of drives with him into industry.

What does industry do to prepare itself for the men it receives from colleges? Are there ways in which an industry can accommodate the drives which motivate its personnel? How can industry capitalize on them? Every industry projects a personnel image by virtue of its very existence. If it fails to project an image of its own design, it acquires one by default. The image of the electronics industry is an excellent example. To the public, electronics is the "brains" industry. It has projected a vigorous, exciting image. By contrast, many older industries now are concerned that they have projected depressing, stodgy images. If the air conditioning industry is to profit by the mistakes of others, it must determine the image it wants, project it, and live up to it.

Immediate attention to this long-range personnel plan is especially important because there are things happening elsewhere in personnel that will have considerable impact on the personnel image of the industry. For example, the American Society for Engineering Education is considering seriously backing the abandonment of the engineering degree at the bachelor's level. In a manner parallel to the medical profession, the first degree in engineering would be at the graduate level. Simultaneously, there is a powerful movement to develop more two-year technicians "to do the work now done by engineers" although the new work to be done by engineers still is undefined. Also taking shape are four-year degree programs which add to the two-year technician a broad coverage in general education and make him a general technologist.

In which direction does the air conditioning industry wish to look for its personnel? Is it prepared to adapt itself to changing times and changing educational patterns? There are numerous other examples, including professionalization and unionization, which could be used to accentuate a simple point: Things are stirring on the personnel front and the air conditioning industry would do well to take heed and plan ahead. New personnel patterns already are beginning to emerge in other industries. Will the air conditioning plan be by design or default?

PLANNING OF THE HIGHEST ORDER

The situation calls for long-range planning of the highest order. The talented boy in high school today will just begin to assert himself in industry about 1970. Is the air conditioning industry prepared to attract him, to accept him, and to do right by him? The long-range personnel plan which I propose to be developed needs to transcend all normal boundaries. A tremendous amount of good is being done by scholarships, loan funds and other generous programs within segments of the industry. But these need to be integrated into a total plan which delves deeply into basic philosophical and policy matters and which projects a dynamic image of the industry. The plan needs to be much more than a mere recruitment device. It needs

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Harold P. Hayes is Dean of Engineering at California State Polytechnic College. He recently addressed the ASHRAE Southern California Chapter with "Personnel: Vision or Vanish", of which this is a somewhat condensed version.

to be a fundamental concept of what the industry will offer in status, security and individual satisfaction in exchange for the dedication and talents of its personnel. The industry image must not be a blurred reflection but must indicate substance.

I have no specific plan to offer but I do want to suggest some of the questions that might be asked as a plan is developed. The following are not all-inclusive but do indicate some needed thinking.

Status

Are there outstanding graduate schools and other educational centers which serve the industry?

Is there professional licensing or its counterpart in the name of the industry?

If I am 21 years of age and eager to carve a name for myself in the industry, how do I do it? What are the success patterns?

Security and Stability

Are personnel vulnerable to disappearing jobs?

Is the industry planning ahead to grow on behalf of its employees and is it opening new horizons and constantly widening its vistas?

If I have invested 15 or 20 years of my life in the industry, can I always use this experience to good advantage?

Individual Satisfaction

Is there professional recognition of the individual contribution?

Is there the excitement of new challenge in the industry?

Is there unlimited opportunity for continued education and professional growth?

In brief, I envision an industry-wide plan which pledges status, stability, and unlimited opportunity for individual growth to talented young men. I envision an industry which wholeheartedly supports the pledges made in the plan and which projects an image of planning on behalf of its personnel.

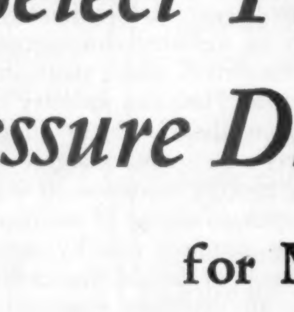
If the air conditioning industry shows vision in long-range personnel planning, it can scale heights that may now seem to be quite unattainable.

I urge the industry through whatever channels exist, or through new channels if necessary, to pursue a long-range plan for personnel.

I urge the industry to show extraordinary vision and for its great leaders to step forth and make the long-range plan a dynamic reality.

How to Select Pumps and Apply Pressure Drop Curves

for MTW systems



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Member ASHRAE

Increased design temperature drop which permits use of much smaller piping and pumps is the basic reason for MTW design. Design temperature drop should be recognized as a tool; tools must be sized for the job at hand. Most large systems today use an undersized tool, the 20-deg T.D. design base. The 20-deg T.D. design base was originated for residential design primarily because 10,000 Btu/hr/gpm is a good round number which permits simple determination of required flow rates. Design temperature drops over 20-deg do not return great economic benefits for residential design because 1-in. pipe does not cost a great deal more than ¾-in. pipe, either to buy or install. Pump sizes are so small as to prevent any savings by an increased design temperature drop.

The 20-deg T.D. design base was never intended for overall use on large system design. The large system, designed by the consultant, differs considerably from the residential system. A pipe size change from 4 to 2½ in. will make a considerable cost difference, as will a pump size change from 20 to 5 hp. Pipe and pump size reduction of this order can be obtained by use of increased system temperature drop. This is because the amount of heat conveyed in pipe by a given water flow rate is directly dependent on the water temperature drop; 50,000 Btu/hr will be carried by five gpm at a 20-deg T.D.; the same 50,000 Btu/hr will be carried by one gpm at a 100-deg T.D. Decreased flow rate will reduce both pipe and pump size. In general,

G. F. Carlson is an engineer with the Bell and Gossett Company. This paper was presented at the MTW Symposium at the ASHRAE Semiannual Meeting in Chicago, Feb. 13-16. Other papers, presented at this same Symposium by authors Homer Bird and S. W. Miller, appeared in our April and May issues, respectively.

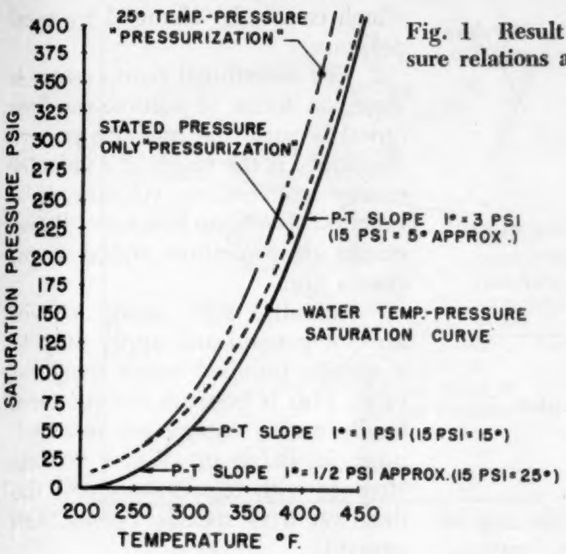


Fig. 1 Result of changing temperature-pressure relations as temperature increases.

Fig. 3 General and specific pump curves

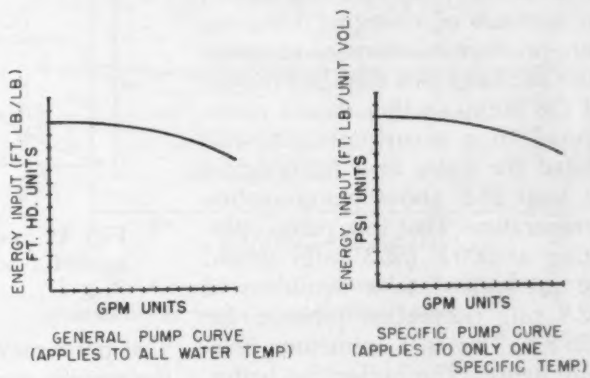
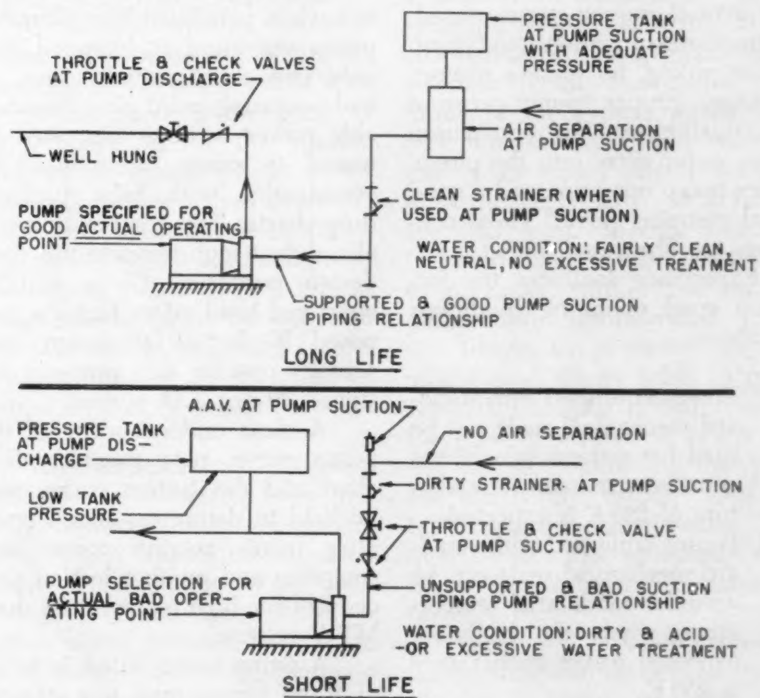


Fig. 2 Conditions under which a mechanical sealed pump will operate at considerably higher temperatures as opposed to less favorable conditions



each doubling of design temperature drop will result in a decrease of one pipe size and will reduce pump power requirement by one half.

Most "off the shelf" heat transfer units are designed for a 20-deg T.D. As temperature drop is increased, flow rates are reduced. This can create problems in stock heat transfer units (air handling, free convection) because the reduced flow rate can adversely affect heat output ability and air purging water velocities and cause stratification.

Two proposals have been outlined previously at the Symposium for increasing design T.D. for the hot water system. These proposals can be applied to both LTW as well as MTW systems. S. W. Miller proposes that the air handling heat transfer units be recircuited, so that the heat transfer unit would be selected for the increased design temperature drop.

H. N. Bird has another engineering approach: he uses the distribution piping mains only for heat distribution. In a sense the main is simply an extension of the boiler. Heat is bled from the main into the separate heat exchange units or zones by a small pump separately circulating these units or zones. Quite high main temperature drops, approximately HTW design drops, can be achieved, even for LTW systems. At the same time individual unit T.D. need not exceed 20 deg, allowing use of standard "off the shelf" heat transfer with refined control. An increase in supply water temperature from an LTW 250 deg maximum to MTW (300 deg neighborhood) permits even greater temperature drop, and still allows use of standard heat exchange as circuited for 20-deg T.D. or as recircuited for the higher T.D.

Use of MTW introduces questions as to pump application and selection. Gland or mechanical sealed pumps are available. The gland type pump requires constant system water leakage through the packing, necessitating constant fresh make-up water addition. This is counter to a basic design criterion for the water system: that it be designed closed and sealed. Given an actual closed sealed design, the water system is inherently corrosion proof. It will last as long as the building it serves. The mechanical seal type pump is preferred because it does not leak.

All centrifugal pumps must operate under good suction conditions. Flow of water exclusively through the pump must be assured. Adequate pressurization

(anti-cavitation) and elimination of air before water entry into the pump is therefore necessary. Pump suction pressure for the mechanical sealed pump should be defined in terms of temperature-pressure, as a result of changing temperature-pressure relations as temperature increases (see Fig. 1). Pressure at the pump suction should correspond to a saturation pressure stated for water at a temperature at least 25 F above pump suction temperature. That is, a pump operating at 300 F (52.3 psig) should be pressurized to a minimum of 82.8 psig (saturation pressure for 325 F). This is a minimum pressure figure. The higher the better, within equipment pressure allowances.

Under the following conditions the mechanical sealed pump will operate at temperatures considerably over those sometimes stated: adequate pressurization, good pump suction piping, no suction strainer blockage, proper pump-pressure tank relationship, air elimination before water entry into the pump, no dry pump operation and a good actual pumping point. These conditions are illustrated in Fig. 2.

Experience indicates the following good operating conditions can obtain:

(1) Pumps equipped with standard mechanical seals can be used for systems in which a constant maximum temperature of 225 F is expected.

(2) Pumps equipped with standard mechanical seals can be used for modulated temperatures where the maximum expected water temperature is 250 F.

(3) Special seals are available for pumps operating at constant temperatures between 225 and 300 F and for modulated temperatures between 250 and 300 F.

(4) Water cooled, gland type pumps are also available for operating temperatures in the neighborhood of 300 F and over.

One of the conditions previously stated is a good actual operating point. The best operating point is often about midway on the pump curve (plus or minus about ¼).

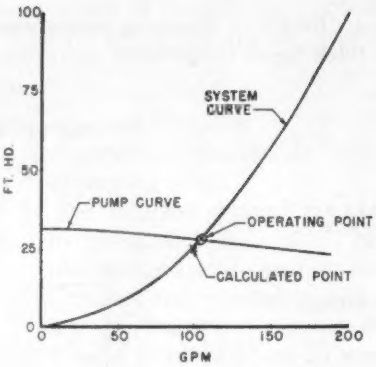


Fig. 4 System curve plotted against a pump curve

This point may vary depending on the specific pump design, however. A good operating point is at least on the pump curve while a bad point is on the tail end or off the curve.

Bad operating points can result when paralleled base mounted pump operation is intended, but only one pump actually runs. A bad operating point plus considerable power wastage can often be traced to safety factor head in combination with false pressure drop charts. This combination will also defeat high temperature drop design purposes. Given a false chart and head safety factor a proposed 50-deg T.D. design may actually operate as a properly designed 20-deg T.D. system.

A clear understanding of the pump curve, pipe pressure drop chart and the system curve must be held to determine actual operating points, relative power consumption and pump selection procedures for high temperature drop MTW systems.

A pump curve stated in terms of ft hd versus gpm is a general statement, within broad viscosity limitations, of pump capacity; regardless of the water temperature pumped. The pump curve applies to chilled and low temperature water as well as to medium temperature design providing sufficient anti-cavitation suction pressure is maintained (see Fig. 3). The pump curve is general because of the units used. Ft hd on a pump curve means usable pump energy input; ft lb pressure energy added per lb of water pumped. The pump raises each lb of water pumped to a height stated by the curve as ft hd. Energy per lb is a basic term which cannot be changed by temperature.

The centrifugal pump curve is stated in terms of volumetric flow (gpm) because the pressure energy developed is the result of a velocity energy conversion; velocity is a function of volume flow rate. Pump curves are sometimes stated as psi versus gpm.

Actually, such pump curves are not general and apply only to a specific pumped water temperature. This is because the psi term finally means energy per unit volume; in. lb/cu in. Water volume changes with temperature and the description is specific rather than general.

The pump curve is also a power statement. The pump raises each lb of water passing through it to a new energy elevation at a time rate determined by the flow rate. Flow rate in gpm can be changed to lb/hr when given the density as defined by water temperature. The resulting power (water hp) put into the water by the pump is then:

$$\text{Power} = \frac{\text{ft hd} \times \text{gpm}}{\text{K}} \qquad \text{(Eq. 1)}$$

Where:
ft hd = ft lb/lb
K = conversion factor; gpm to lb/min and ft lb/min to hp

Ft hd × gpm is then a relative approximation of the water power input at any given point on the pump curve. This approximation will be used later to illustrate relative power requirements as affected by specific pipe pressure drop charts used for pump selection and as affected by the design temperature drop.

Pump selection and determination of the actual operating point for any given piping configuration is a simple application of the First Law of Thermodynamics. The energy provided by the pump and put into the water as available energy head is equaled exactly by the energy lost from the water by friction during flow through the piping circuit. Energy in must equal energy out. On any hydronic system the point of operation on the pump curve will be dictated by piping system characteristics. Pump flow must exactly match system flow. Pump head must exactly

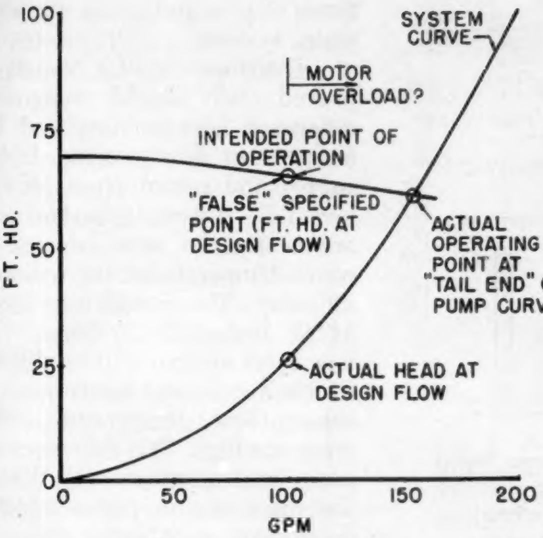


Fig. 5 Chart of pump operating in accordance with actual clean piping circuit pressure drop

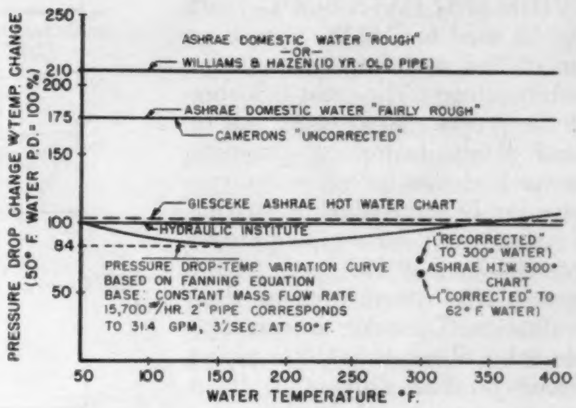


Fig. 6 Comparison of general pressure drop variation as water temperature varies

match system pressure drop. The First Law must apply.

After its design the piping system is fixed, and, for any proposed water flow, a definite pressure drop will result. Calculation of system pressure drop at design flow rates considers one such condition. Individual pressure drop calculations could be made for eaeh of a large number of proposed water flows. A curve, called the system curve and illustrating the change in system piping pressure drop due to changes in system flow, can be plotted from these calculations.

Individual pressure drop calculations are not necessary to plot the system curve. One curve point has already been provided; pressure drop at design flow rate. The system curve can be easily calculated and plotted by observing that pressure drop (H) in a fixed piping circuit varies approximately as the square of the change in flow rate (Q). The formula defining this statement is shown below:

$$\frac{H_1^{1/2}}{Q_1} = \frac{H_2^{1/2}}{Q_2}$$

Where:

H_1 = calculated pressure drop, ft
Q_1 = design flow rate
Q_2 = system flow for system pressure drop H_2

(Eq. 2)

This relationship permits simple slide rule calculation by:

$$\frac{\text{Head on A (square root) scale}}{\text{gpm on C scale}}$$

When the system curve is plotted on a pump curve, the intersection of the pump curve with the system curve is the point of pump operation for the specific pump on the specific piping circuit described by the system curve. It is the only point at which pump head equals system head and pump flow equals system flow. A typical system curve, based on a design flow rate of 100 gpm and a system pressure drop of 25 ft, is shown plotted against a pump curve in Fig. 4.

The defined point of pump operation as illustrated will not apply, however, unless the system curve closely approximates actual system pressure drop. Pipe pressure drop charts must illustrate system piping pressure drop, if we are to actually define the pumping point. A great variety of pressure drop charts is used presently for pipe sizing and pump selection purposes. Many of the charts used illustrate artificial pressure drops on the order of twice that actually encountered in the closed sealed water system. These charts usually introduce an age safety factor. The relative pressure drop valves of some commonly used pressure drop charts are shown in Table I.

The CW, LTW, MTW and HTW system should be closed and sealed. The piping cannot corrode or roughen because the system is inherently protected against corrosion. Piping should be designed to clean new pipe conditions, since the pipe does not age roughen. A pump selection based on an age roughened pipe pressure drop chart is artificial in terms of the actual pumping point. The pump is not concerned with the specified pump selection point. It sees only the inside of the system piping, and will pump in accordance with actual clean piping circuit pressure drop; not necessarily to a falsely specified point. In Fig. 5, it will be noted that the false point leads to operation farther out on the pump curve than intended.

Illustration of the various commonly used charts leads to questions determining which chart is the most applicable to MTW 300 deg design, considering that present charts are usually used for LTW and for chilled water. The question is then proposed: what effect does temperature have on pressure drop?

Change in pressure drop with temperature can be defined by use of the Fanning equation with Moody's friction factor–Reynold's No. relationship. This comparison can be made for a constant mass flow rate, changing only the temperature. This comparison (see Fig. 6) illustrates the general pressure drop variation for a water temperature change from 50 to 4200 deg, and is plotted against commonly used charts.

Relatively close Giescekе (ASHRAE Hot Water), Hydraulic Institute and proposed Fanning equation-temperature check agreement should be noted. The above would indicate that the Giesceke (Hot Water Chapter ASHRAE

GUIDE AND DATA BOOK) chart can be used for MTW, as well as for chilled and low temperature water systems. The great influence of the pressure drop chart and of head safety factor on pumping power and size for all water systems can be established by striking a system curve for a piping circuit intended to flow 100 gpm. At 100 gpm, a true system pressure drop evaluation (Giesceke or comparable value chart) indicates a piping circuit pressure drop of 25 ft. A system curve based on this value is drawn. Were other pressure drop charts to be used, with safety factor applied, correspondingly higher head selection points would be obtained. This is illustrated in Fig. 7.

For all selection points, various pumps meeting the specified pump point would be selected. Proposed pump curves are shown plotted against the selection points. The actual pump operating point will be at the intersection of the true system curve with the pump curve. Relative power requirements can be assessed by a gpm ft hd relation as shown in Table I.

It will be noted that safety factor head addition plus a false pressure drop chart greatly oversizes the pump. It can also be seen that MTW design to a false pipe pressure drop criteria defeats the MTW design purpose—high design temperature drop. Under these conditions, the improperly evaluated MTW system can provide less economic return than a properly designed LTW system.

Decrease in power requirement that can be realized by combining increased temperature drop with good pipe pressure drop chart evaluation can be illustrated generally in terms of water hp (Table II). Advantages of design to maximum T.D. combined with good pressure drop charts are obvious.

Fear of the unknown is the

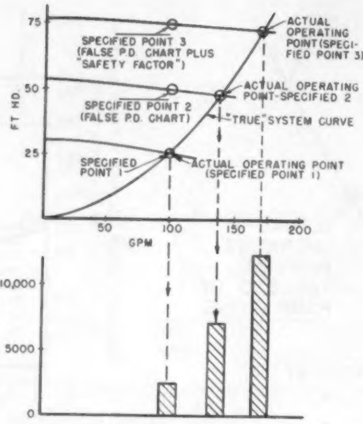


Fig. 7 System curve based on a piping circuit pressure drop of 25 ft in a circuit intended to flow 100 gpm

most insidious enemy to design for maximum engineering economics. Fear leads us to add safety factor. An evaluation of the heating or cooling system as a heat transfer machine clearly illustrates that a flow increase over the design condition does not add appreciably to heat transfer, our ultimate concern. Safety factor head addition and age safety factor pressure drop charts (Cameron's uncorrected, etc.) do not increase heat transfer safety factor, but do increase cost, and may cause control and pump problems.

Large system design today is going through revolutionary changes caused by design methods which propose high design temperature drops. Our working tools (P.D. charts) must be evaluated and brought up-to-date in term of present and future needs. Accurate P.D. charts must be provided for all systems: CW, combined CW & LTW, LTW, MTW and HTW. It is the author's opinion that a "society approved" chart can be developed by a special ASHRAE sub-committee which will meet this need and help eliminate the tremendous present day wastage in

Table I

Temperature Drop	System Type	P. D. Chart	50% Head Safety Factor	Relative "Water Power"
20°	LTW	False	Yes	40
20°	LTW	False	No	24
20°	LTW	Good	No	8
40°	LTW	Good	No	4
80°	LTW or MTW	Good	No	2
160°	MTW or HTW	Good	No	1

terms of pipe and pump size for all water systems.

Development of a Society approved chart should recognize a difference between low and high temperature drop systems. In both supply and return piping for the low T.D. system, gpm flow rates are nearly the same because the water temperatures are not much different. This is not true for the MTW high T.D. system. Water flow rates in gpm will be different for the supply and return main because these temperature differences are high. This difference proposes two questions. (1) What is the difference in pump selection, depending on whether the pump is in the supply or return main? (2) How do we add calculated supply main head to calculated return main head when supply and return temperature differences are high?

Answers to these questions will develop in discussion of how a single chart, applicable to all water systems (CW, LTW, MTW and HTW) and to all system temperature drops, could be resolved. The basis for the chart should be our best present day knowledge concerning pipe P.D.; the Fanning equation – Moody's friction factor relationship. This relationship could immediately provide us with a gpm vs ft hd chart suitable for use with CW. This chart is shown as Fig. 8, and would be to basic Hydraulic Institute values.

While we are accustomed to the use of gpm in our design, it does not follow that gpm should be our design criteria. We are more interested in heat conveyance, Btu/hr moved through the piping. Btu/hr conveyed is a function of mass flow rate (lb/hr) and temperature drop. Given the Btu/hr flow requirement for a specific pipe, it is a simple matter to determine lb/hr mass flow rate; simply divide Btu/hr requirement by temperature drop (1,000 mbh at 100-deg T.D. = 1,000,000 divided by 100 = 10,000 lb/hr mass flow rate).

Conversion to mass flow rate charts will most simply provide for high temperature drop systems and will provide another important service, that of breaking the design strangulation forced on us by design to round number flow temperature drop relations. Who is to say that three gpm per ton (8 deg

rise CW) or one gpm per 10,000 Btu (20 deg T.D. LTW) are sound economical designs for all conditions.

The ft hd vs gpm chart previously described can be changed to ft hd vs lb/hr mass flow rate, by observing that one gpm flow rate at about 40 to 60 F corresponds to 500 lb/hr mass flow rate. Given this relation, the previous chart could be illustrated as in Fig. 9.

This chart is now similar to the Giesceke chart (LTW chapter ASHRAE GUIDE AND DATA BOOK), except that the new chart would be stated in lb/hr mass flow rate only, rather than lb/hr mass flow rate times a specific temperature drop (Btu/hr at 20 deg T.D.). Important to further development of the chart for use with MTW and other high temperature drop systems is an evaluation of the term ft hd as it appears on this chart and as stated by the Fanning equation. It is the author's opinion that the term ft hd means energy loss, ft lb/lb fluid flowing in the pipe. The term represents fluid pressure energy loss in the same way that ft hd means fluid pressure energy addition on a pump curve.

Given the proposition that ft hd means pressure energy loss, it can be agreed that pressure drop (ft hd) for a 300 F supply main can be added directly and without correction to that for a 200 F return main. This is because an energy statement is not subject to temperature correction. The only requirement is that the pressure drop chart itself be corrected for the water temperature flowing.

This can be done by determining at specific mass flow rates the change in ft hd pressure drop through pipe as caused by temperature changes. These changes are approximated in Fig. 6. An illustrative chart, suitable for use on CW, LTW, MTW and HTW could be constructed as in Fig. 10.

It should be noted that charts stating ft hd as corrected to 62 F water head, or as stated to psi loss per 100 ft, do not retain a pressure energy loss per unit weight meaning. It is the author's opinion that such charts are theoretically incorrect, since they ultimately lead to contradiction of the First Law of Thermodynamics when applied to

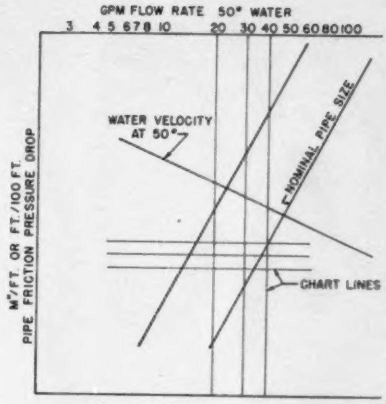
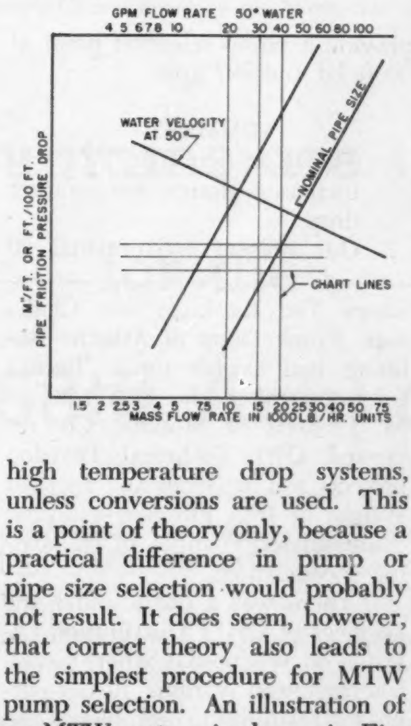


Fig. 8 A chart resolved for applicability to all water systems and system temperature drops

Fig. 9 Ft hd versus lb/hr mass flow rate



high temperature drop systems, unless conversions are used. This is a point of theory only, because a practical difference in pump or pipe size selection would probably not result. It does seem, however, that correct theory also leads to the simplest procedure for MTW pump selection. An illustration of an MTW system is shown in Fig. 11.

The use of 300 F water in the supply main with 200 F water in the return main means that gpm flow rate is not constant in the piping circuit. Mass flow rate (lb/hr) must be constant, however. Therefore,. mass flow rate is used for design, determined by dividing Btu/hr heat requirements by temperature drop. Pressure drop is determined for the 300 deg supply main by the generalized chart. A similar calculation is made for the 200 F main. The ft hd pressure drop for the 300 F main is added directly to that for the 200 F return main because the ft hd energy requirement statement cannot itself be effected by temperature, providing the ft hd requirement has been established at the water temperature flowing. This has been provided for by the P.D. chart.

The pump head selection point must remain constant, regardless of whether the pump is located in the supply or return main. The required ft hd (energy requirement) for a stated system mass flow cannot change for a fixed piping circuit at fixed temperature conditions; the pump does not establish required energy level, it simply meets the energy requirement.

The pump curve is stated in terms of ft hd vs gpm, however, and it is obvious that, for any system operating at high temperature differentials, the gpm selection point for any given mass flow rate can change with pump location. When flow rate through the piping circuit is defined in terms of mass flow rate, the gpm pump selection point is determined by an evaluation of the volume (gpm) flow rate through the pump at the water temperature pumped.

For example, a pump is to be selected for a mass flow rate of 100,000 lb/hr. Overall system pressure drop is 50 ft. The pump is to be installed on the 300 F supply main. The point of pump selection would be 50 ft hd at 100,000 lb/hr

Table II

Pressure Drop Chart	Base	Relative Pressure Drop
Giesceke (ASHRAE Hot Water Chapter)	ASHRAE Test	100%
Hydraulic Institute	Fanning-Moody	100%
Camerons "Uncorrected"	Williams-Hazen	175%
ASHRAE Domestic Water (Fairly Rough)	Williams-Hazen	175%
ASHRAE Domestic Water (Rough)	Williams-Hazen	210%
ASHRAE High Temp. Water Chapter (300 deg)	Stoever (Smooth Tube)	70%
Min-Potter (300 F—Corrected for Temp.)	Fanning-Moody (But not to Nominal Pipe Size)	100%

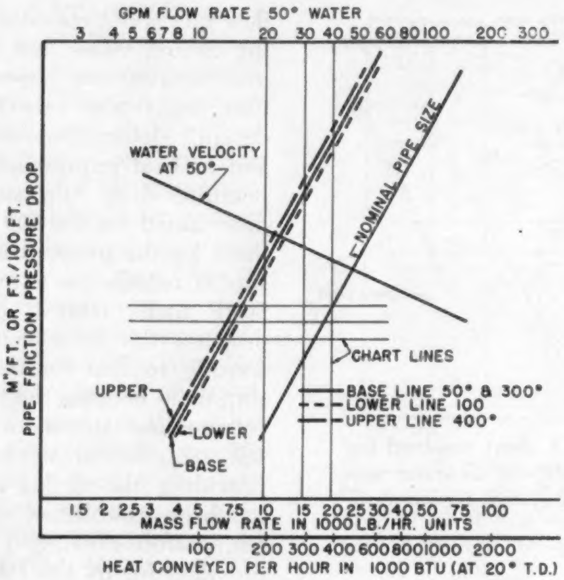


Fig. 10 Suitable for use on CW, LTW, MTW and HTW

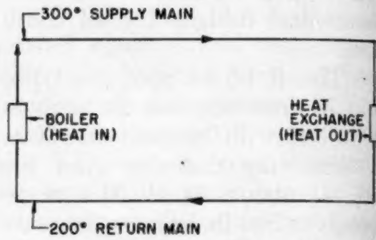


Fig. 11 An MTW system

mass flow rate converted to gpm for water at 300 F. The gpm selection point is then: 100,000 lb/hr × gal/7.61 lb × hr/60 min = 220 gpm. The pump is selected at 50 ft hd, 220 gpm. Were the pump to be installed on the 220 F return main, a similar conversion would provide a pump selection point at 50 ft hd and 207 gpm.

SUMMARY

1. The basic reason for MTW is increased design temperature drop.
2. Our present conventional 20 F T.D. design base was never intended for overall large system design.
3. High design T.D. can be obtained for LTW systems by new design proposals.
4. MTW design will extend the T.W. otherwise available and with new engineering approaches, will permit greatly increased T.D.
5. Pumps are available for MTW system design, providing good suction conditions are established.
6. False pressure drop charts work against best economics and can cause pump problems.

LAST FOR OHI: FIRST FOR NOFI

When the Oil Heat Institute of America met in Washington, D. C., April 25-27, for its 39th Annual Convention it was the last OHI meeting. Newly-merged with the National Fuel Oil Council, the successor organization becomes the National Oil Fuel Institute.

Convention Committee Chairman Francis Schuster accented the theme of increasing the efficiency of dealer, jobber and distributor operations. Indeed, the whole program was most closely allied with these functions. At the Technical Division Symposium on Tuesday, where Ted Kaufman was Chairman, Frank Dunn of Atlantic Refining had as his topic "Burner Service Makes the Difference," M. J. Reed of Mobiloil Co. reviewed OHI Technical Division projects and activities and Richard Wright of Iron Fireman analyzed contemplated changes in oil heating specifications.

There was a clinic under the auspices of OHI's Distribution Division on Wednesday where panelists reviewed various dealer-purchaser relationships, problems and sales opportunities. The Commercial-Industrial Sessions were spread over three days to bring special programs allied with architects, engineers, builders and equipment factors.

Feature speaker at the Meeting was President Glenn L. Werly of the new National Oil Fuel Institute, whose topic was "The Oil Heating Industry's Future." President Werly re-emphasized the importance of research and growth information in keeping vital the future programs of NOFI. He urged coordination of the results already accomplished by OHI and NFOC if the foundation for future accomplishments by the new organization is to be made most fully effective.

NEWS REPORT OF DENVER MEETING TO BE IN THE AUGUST JOURNAL

Full recording of significant events, by word and picture, at the ASHRAE 68th Annual Meeting, Previewed in this issue, will appear in the August Issue of the JOURNAL.

Technical Sessions will be reported upon, as will the Symposiums. Social events and business sessions, too.

Look for the report of this meeting in your August JOURNAL.

Beyond Denver's Civic Center, to the West, lies this panorama

Rocky Mountains are the setting for the ASHRAE 68th Annual Meeting

For our 68th Annual Meeting, the American Society of Heating, Refrigerating and Air-Conditioning Engineers will convene in Denver, Colo., from June 26-28. Headquarters for this meeting will be at the Denver Hilton Hotel.

New officers will be installed at the Banquet on Tuesday evening. Under the final phase of the Plan for Consolidation, John Everetts, Jr., will become President. Official nominees for other offices are: John H. Fox, First Vice President; Frank H. Faust, Second Vice President; and John E. Dube, Treasurer. Mr. Everetts and his officers will hold office until the next Annual Meeting, thus marking the resumption of annual terms of office (for the first time since the merger).

Four technical sessions have been scheduled; a total of 15 comprehensive papers covering diversified subjects will be presented. There will be four Symposiums—Industrial Ventilation (Laboratory Hood Design), Air Conditioning (Window Units or Central Systems?), Food Refrigeration (Use of Liquefied Gases for Low-Temperature Food Handling) and Domestic Refrigerator Engineering (Organizing for Quality).

Seven Forums are being planned on the following topics: Tunnels vs. Burial of Heating, Air Conditioning and Utility Lines; Introducing and Controlling Humidity in Heated Living Spaces; ASHRAE Research Status; Industrial Heat Recovery; Integration of Lighting and Air Conditioning; Internal Motor Protectors for Hermetic Refrigeration Compressors; and Problems of High Altitude Installations.

As is customary, numerous committee meetings will take place during the gathering.

Social events and tours of the area are being arranged with care. The Welcome Luncheon will take place on Monday. As indicated earlier, the Banquet will be held Tuesday evening.

This is the Black Canyon of the Gunnison

Of special interest to members should be a technical tour of the Bureau of Standards Cryogenics Laboratory in Boulder, a technical tour of the United Airlines Flight Training Center in Denver and a Mountain Tour and Chuck Wagon, which will include a visit to historic Central City. In addition, a tour of the Denver Art Museum has been organized for the ladies. A golf tournament will round out the social program.

An outline of the complete program, subject to last minute changes and to rearrangement and possible reassignment, follows.

First Technical Session

New Development in Steam Vacuum Refrigeration—Elliot Spencer, Sales Application Engineer, Graham Manufacturing Co., Inc.

A Thermodynamic Investigation of a Refrigerant Expansion Engine—Thomas M. Olcott, Senior Propulsion Engineer, Convair and Harold A. Blum, Professor, Mechanical Engineering Department, Southern Methodist University.

Discussion of Some Strength Characteristics of Ice at the Interface—J. K. Stene, Associate Professor of Mechanical Engineering and W. E. Fontaine, Professor of Mechanical Engineering and Director for Engineering Research, Ray W. Herrick Laboratories, Purdue University.

Heat and Mass Transfer in Dehumidifying Surface Coils—W. L. Bryan, Associate Professor, Department of Mechanical Engineering, Case Institute of Technology.

Second Technical Session

A Study of Fluid Flow through Flexible Orifices—R. D. Ulrich, Professor, Mechanical Engineering Department, Brigham Young University, W. E. Fontaine, Professor of Mechanical Engineering and Director for Engineering Research, Ray W. Herrick Laboratories, Purdue University and O. W. Witzell, Professor of Mechanical Engineering, Purdue University.

Degradation of Polyester Film by Alcohols when Used as Additives in Refrigeration Systems—Claus J. Bushouse, Hermetic Motor Department, General Electric Co.

Solubility of Refrigerants 11, 21 and 22 in Organic Solvents Containing a Nitrogen Atom and in Mixtures of Liquids—Allen Thieme, 2nd Lt., U.S. Army, Chemical Corps, U.S.A. Cmlc Nuclear Defense Lab. Army Chem. Center and Lyle F. Albright, Professor, School of Chemical Engineering, Purdue University.

Refrigerating Capacity and Performance Data for Various Refrigerants, Azeotropes and Mixtures—R. C. McHarness and D. D. Chapman, Freon Products Lab., Organic Chemicals Department, E. I. duPont de Nemours and Co., Inc.

Third Technical Session

Solar Heat Gains through Domed Skylights—L. F. Schutrum, Research Supervisor, ASHRAE Research Laboratory and N. Ozisik, Oak Ridge National Laboratory.

Air Infiltration through Revolving Doors—L. F. Schutrum, Research Supervisor, C. M. Humphreys, Assistant Director of Research and J. T. Baker, Research Engineer, ASHRAE Research Laboratory and N. Ozisik, Oak Ridge National Laboratory.

Evaluation Procedure for Odor-Control Methods—William F. Kerka, Research Engineer, ASHRAE Research Laboratory.

Daily Insolation on Surfaces Tilted toward the Equator—Benjamin Y. H. Liu, Assistant Professor and Dr. Richard C. Jordan, Professor and Head, Department of Mechanical Engineering, University of Minnesota.

Fourth Technical Session

Calculated Temperature Rise in Round Ducts—J. Richard Wright, Assistant Professor of Mechanical Engineering, Tennessee Polytechnic Institute, and Edward J. Brown, Research Assistant Professor of Mechanical Engineering, University of Illinois.

A Unique Hot-Box Cold-Room Facility—W. P. Brown, K. R. Solvason, and A. G. Wilson, Head, Building Services Section, Division of Building Research, National Research Council of Canada.

Integrated Load Technique for Estimating Annual Energy Use of Central Air-Conditioning Plants—A. Eugene Congress, Head, Air Conditioning and Research Section, Power Generation Branch, Department of the Navy.

Industrial Ventilation Symposium: Laboratory Hood Design

Chairman: Robert Jorgensen, Assistant Chief Engineer, Buffalo Forge Company.

Basic Requirements of Laboratory Hoods—J. C. Burke, Jr., Head of Mechanical Engineering, Tracy-Behrent.

Design of Hoods—E. J. Williams, Supervisor-Mechanical Engineering, Abbott Laboratories.

History of the Use of Fume Hoods—G. T. Saunders, Manager, Scientific Equipment Div and L. N. Nelson, Head, Engineering Department, Kewaunee Manufacturing Co.

Materials and Construction—T. B. Lanahan, Chief Engineer, S. Blickman, Inc.

Air Conditioning Symposium: Window Units or Central Systems?

Chairman: W. R. Moll, Sales Manager, Air Conditioner and Dehumidifier Sales to Sears, Whirlpool Corp.

Food Refrigeration Symposium: Use of Liquefied Gases for Low-Temperature Food Handling.

Chairman: Dr. Aaron L. Brody, Product Development Manager, M & M Candies.

The Role of Liquefied Gases in the Frozen Food Field—Kirby M. Hayes, Associate Professor, Department of Food Technology, University of Massachusetts.

Relative Merits of Various Gas Liquefying Cycles for Use in Freezing and Transportation of Foods—Samuel C. Collins, Professor, Department of Mechanical Engineering, Massachusetts Institute of Technology.

Effects of Ultra-Low Temperature on Foods—Dr. Walter A. Maclinn, Director, The Refrigeration Research Foundation.

Commentary—V. J. Johnson, Chief, Cryogenic Data Center, National Bureau of Standards, U.S. Department of Commerce.

Multi-Stop Delivery of Frozen Foods Using Liquid Nitrogen Refrigeration—J. J. Kane, Project Engineer, Cryogenic Products Development Department, Linde Co., Div of Union Carbide Corp.

Use of Liquefied Gases for Freezing and Shipping of Foods—Robert C. Webster, Manager, Customer Service Laboratory, Air Reduction Sales Co.

Car and Truck Pre-Cooling and Post-Cooling with Carbon Dioxide—John P. Antolak, Director, Carbon Dioxide Technical Sales, Liquid Carbonic Div, General Dynamics Corp.

Commentary—Irving J. Pflug, Professor, Department of Food Science, Michigan State University.

INSULATION WAS THE THEME AT THE CHICAGO DOMESTIC REFRIGERATOR ENGINEERING SYMPOSIUM PAGE 70

Domestic Refrigerator Engineering Symposium: Organizing for Quality

Chairman: E. J. Von Arb, Vice President, Director of Engineering, Revco, Inc.

Keynote Address—Morris Kaplan, Technical Director, Consumers Union.

Total Quality Control — William J. Masser, Manager of Quality Control Engineering Service, General Electric Co.

Quality Control in Operation—Ray Sonderup, Manager, Quality Control, Appliance Operation, Philco Corp.

Relationship of Cost Reduction vs. Quality—William E. Mahaffay, Vice President of Engineering, Whirlpool Corp.

Forums

Chairman: R. S. Buchanan, Assistant Director of Appliance Engineering and Research, American Motors Corp.

Tunnels vs. Burial of Heating, Air Conditioning and Utility Lines—Moderator, Paul F. Cummings, Architectural and Engineering Div, Minnesota State Department of Administration.

Introducing and Controlling Humidity in Heated Living Spaces—Moderator, A. G. Wilson, Head, Building Services Section, Division of Building Research, National Research Council of Canada.

ASHRAE Research Status—Moderator, E. P. Palmatier, Carrier Research and Development Co.

Industrial Heat Recovery—Moderator, John H. Clarke, Visking Co.

Integration of Lighting and Air Conditioning—Moderator, Walter Spiegel, Charles S. Leopold, Inc.

Internal Motor Protectors for Hermetic Refrigeration Compressors — Moderator, Joseph Kumler, Vice President, Research and Engineering, Ranco Incorporated.

Problems of High Altitude Installations—Moderator, Donald D. Paxton, Vice President, Bridgers and Paxton.

Loch Vale in Rocky Mountain National Park is one of many scenic showplaces within easy distance of Denver

ABSTRACTS OF TECHNICAL SESSION AND SYMPOSIUM

FIRST TECHNICAL SESSION—MONDAY, JUNE 26, 9:30 A.M.

New development in steam vacuum refrigeration

ELLIOT SPENCER

Associate ASHRAE
Sales Application Engineer
Graham Manufacturing Co., Inc.

Steam vacuum refrigeration, one of the oldest forms of water chilling devices, is characterized by substantial condenser water requirements which has limited applications to installations accessible to rivers or other inexpensive water sources.

Reduction in condensing temperature results in reduced steam consumption. Systems designed for high condensing temperatures respond to decreased condensing temperature at part-load, or at lower condenser water temperature, with reduced energy requirements to a much greater extent than other chilling water systems.

Substitution of an evaporative steam condenser in which both the flash vapor and motive steam are condensed directly, rather than in a water cooled condenser, permits closer approach to prevailing wet-bulb conditions at all times and results in peak steam consumption similar to that of competing systems.

At reduced load and when the wet-bulb is below design conditions, steam consumption is reduced. A 5 F condensing temperature reduction corresponds to approximately 10 per cent reduction in steam consumption.

Since the entire system is located outdoors, machine-room requirements are eliminated. The system may be located where cooling towers are presently installed; appearance, design and size are similar to cooling towers for systems of similar capacity.

A careful weighing of all cost factors indicates competitive owning and operating costs. Lack of moving parts and simplicity of cycle are favorable to low maintenance and service costs.

A thermodynamic investigation of a refrigerant expansion engine

THOMAS M. OLCOTT
Senior Propulsion Engineer
Convair

HAROLD A. BLUM
Professor
Mechanical Engineering Dept.
Southern Methodist University

The principle of substituting a refrigerant expansion engine for the expansion valve of a vapor compression cycle system is well known. A search of the literature, however, reveals no published data on the performance of such an engine.

This investigation consisted of (1) construction of a simple engine, (2) testing the engine and (3) comparison of its performance with isentropic expansion.

This device did illustrate the above mentioned principle; however, the percentage recovery of the available energy was only as high as 10 per cent. The analysis in this paper shows that the pressure drop and leakage in the valves were major causes of the low energy recovery. If these were eliminated, the percentage recovery could have reached 40 per cent.

A theoretical comparison was made between the single circuit refrigeration system, employing the expansion engine, the cascade system, and the multistage compression system.

Results, when averaged for each temperature and surface, showed definite tendencies which were put into equation form. The equation was derived from the data by the method of least squares in the form, $S = a\,T^b$, where S was the average shear stress in psi for all tests at the absolute temperature T, in deg Rankine. The constants a and b, the latter being negative, are functions of the surface nature and material. This equation written as $S = a(460 + t)^b$ was expanded by the binomial theorem and the terms

PAPERS TO BE PRESENTED AT THE ASHRAE ANNUAL MEETING

ASHRAE will meet at the Denver-Hilton

of small value were discarded. The final form was then $S = c(1 - dt + et^2 - ft^3)$ where S is the average shear stress psi, t is in deg F, and c, d, e, and f are positive constants.

Discussion of some strength characteristics of ice at the interface

J. K. STENE
Associate Professor
Mechanical Engineering
Purdue University

W. E. FONTAINE
Member ASHRAE
Professor
Mechanical Engineering
Director for Engineering Research
Ray W. Herrick Laboratories
Purdue University

Ice that forms on a surface must be removed economically in order for the surface to be useful commercially. Again, ice forms on most cold surfaces where water is present and must be removed to enhance heat transfer to or from the surface. Experiments described in this paper were undertaken to determine some strength characteristics of the solid-ice interface.

Strength of adhesion of ice to a surface was defined as the stress, force of removal divided by the area of contact, that was needed to separate completely the ice from the surface. A further restriction on the tests was that the separation be sudden and without slow sliding at the interface while contact was maintained between the ice and the surface.

In the temperature range tried, 6 to 25 F, no tension tests were valid as all failures included some weakness in the ice itself. In the shear tests it was found necessary to confine the tests to the temperature range below 10 F.

Heat and mass transfer in dehumidifying surface coils

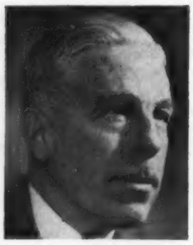
W. L. BRYAN
Member ASHRAE
Associate Professor
Department of Mechanical Engineering
Case Institute of Technology

Experimental results are given for the transfer of mass and heat by a bare surface coil under conditions of measured surface temperature. Data are given for the heat transfer coefficients, for the mass transfer coefficients and for experimental surface temperatures of the dehumidifying coil.

A simple fundamental equation is presented for the actual surface temperature of the coil and the locus of air states through the coil. Attention is given to the fundamentals in present methods of coil calculations relating to the actual coil surface temperature.

R. H. TULL
President

JOHN EVERETTS, JR.
First Vice President
and President-Elect



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SECOND TECHNICAL SESSION—TUESDAY, JUNE 27, 9:30 A.M.

A study of fluid flow through flexible orifices

R. D. ULRICH
Associate Professor
Mechanical Engineering Dept.
Brigham Young University

O. W. WITZELL
Professor of Mechanical Engineering
Purdue University

W. E. FONTAINE
Member ASHRAE
Professor of Mechanical Engineering
Director for Engineering Research
Ray W. Herrick Laboratories
Purdue University

Interest in the problem of flow through flexible orifices arises because of the large variety of flow rate vs. pressure drop relations which have been obtained. Commercial interest thus far has been mainly in applications where a single flow rate is desirable. The ability to predict the flow characteristics of these devices – as they depend on such parameters as type of fluid, pressure drop, geometry and temperature – will in all probability lead to several other applications.

Flow coefficients were obtained and correlated with geometric parameters and an idealized Reynolds number. This allows for direct determination of the flow rate as a function of the pressure drop.

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Third Session

LINCOLN BOUILLON
Chairman
Fourth Session

At the ASHRAE 68th Annual Meeting in Denver

Degradation of polyester film by alcohols when used as additives in refrigeration systems

CLAUS J. BUSHOUSE

Hermetic Motor Dept.
General Electric Co.

Utilizing a sealed glass system composed of reaction tube and attached manometer, the reaction between polyethylene terephthallate film and alcohols was followed by pressure changes at temperatures from 120 to 200 C. The compounds studied were the eight aliphatic alcohols from one through four carbon atoms and water. P-dioxane and tetrahydrofuran were also investigated and found to have no reaction upon the film. This search was initiated to find a substitute for methanol which is sometimes added to compressor units to prevent capillary freeze-up. Methanol has been shown to embrittle the film in units containing this type of motor sheet insulation.

Results of the study showed that methanol and other primary alcohols were much more reactive upon the film than water. Isopropyl and secondary butyl alcohols were found to have approximately the same reactivity as water, while tertiary butyl alcohol was unreactive. However, since p-dioxane, tetrahydrofuran and tertiary butyl alcohol are poor antifreezes and secondary butyl alcohol is not completely soluble in water, there remained only isopropyl alcohol. Using the same type of reaction tube, isopropyl alcohol was also heated in the presence of the film, iron and aluminum. There is evidence of a slight reactivity with the metals above 150 C. Although it is much less reactive toward the film than methanol, use of isopropyl alcohol as an antifreeze in compressor units is not suggested. It should also be proven compatible by exhaustive functional testing in units.

Solubility of Refrigerants 11, 21 and 22 in organic solvents containing a nitrogen atom and in mixtures of liquids

ALLEN THIEME
2nd Lt, U. S. Army,
Chemical Corps
U.S.A. Cmlc
Nuclear Defense Lab.
Army Chem. Center

LYLE F. ALBRIGHT
Professor
School of Chemical Engineering
Purdue University

Solubilities of Refrigerants 21 ($CHCl_2F$), 22 ($CHClF_2$), and 11 (CCl_3F) were studied in several high-boiling, nitrogen-containing solvents which included both aromatic and aliphatic amines, amides, nitro compounds, and nitriles. Binary mixtures of ethers, esters, amines and amides were also evaluated as solvents for the refrigerants. Vapor pressure of the refrigerant above the solution was determined by static methods, assuming that there was no solvent in the vapor phase. Pressure measurements were taken over a large range of compositions at temperatures ranging from 100 F to 250 F.

Octyl amine; octyl cyanide; N, N-dimethyl formamide; N, N-diethyl formamide; N, N-dimethyl aniline; and N-methyl morpholine dissolve more Refrigerants 21 and 22 than predicted by Raoult's Law. Aniline, m-chloro aniline and ethyl formamide dissolve less of the refrigerants than predicted by Raoult's Law. Nitrobenzene and Refrigerant 21 exhibit essentially ideal solution characteristics. The polyethylene polyamines react with the halogenated methanes, producing a complex mixture of amine salts.

Mixtures of dimethyl formamide and Refrigerants 21 or 22 would give higher C.O.P. by about 15 per cent in absorption refrigeration cycles than mixtures of the dimethyl ether of tetraethylene glycol and Refrigerant 21 or 22. Diethyl formamide would also be a slightly better solvent based on solubility considerations for refrigeration than the glycol compound.

Solubilities of the halogenated methanes in mixtures of two solvents were found in the cases investigated to be intermediate between the solubilities in the pure components.

Refrigerating capacity and performance data for various refrigerants, azeotropes and mixtures

R. C. McHARNESS

D. D. CHAPMAN

Freon Products Lab.
Organic Chemicals Department
E. I. duPont de Nemours and Co.

From time to time, engineers have been interested in the relative cooling capacities of various refrigerants. By the use of tables of thermodynamic properties, it is possible to calculate theoretical values for individual refrigerants at any given set of operating conditions and thus make the comparison desired. This method, however, does not take into consideration the efficiency of the compressor and thus does not give the practical answer desired. Operating tests need to be carried out to obtain actual values.

Calorimeter tests have been performed on single refrigerants and on a variety of mixtures to determine how the cooling capacity of one refrigerant is affected by the addition of a second one. Various operating data, such as coefficient of performance, compression ratio, suction and discharge temperatures and pressures, and power requirements, have been obtained during the respective runs and will be reported in this paper.

The calorimeter test stand used in this work contains the basic components found in any refrigeration unit. The motor-compressor unit chosen is a semihermetic commercial one and the condenser is water cooled. The evaporator is mounted in a boiler-calorimeter unit equipped with electrical heaters and containing Refrigerant 11 as the boiling heat-transfer fluid. This unit is thoroughly insulated with polyurethane foam so that heat losses to the atmosphere are negligible. The calorimeter is equipped with the controls necessary to maintain the desired constant operating conditions for long periods. This assures complete dynamic equilibrium throughout the system during the time when actual measurements are being taken. Instruments are provided to measure

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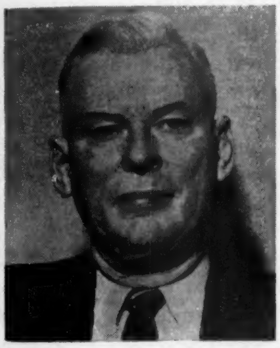

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Meeting Arrangements Committee, 68th Annual Meeting
Denver, Colo., June 26-28, 1961

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accurately the power inputs to the motor (under idling and operating conditions) and to the boiler-calorimeter, as well as the temperatures and pressures throughout the system.

While the calorimeter is capable of operating over a wide variety of evaporator and condenser temperatures, some average conditions in the household-refrigeration and air-conditioning ranges were chosen for this work. All runs were carried out at a condenser temperature of 110 F, with the gas entering the compressor at a temperature of 65 F. Measurements were made at three evaporator temperatures; namely −20, −10, and +40 F. In the case of Refrigerants 13B1 and 22, some additional runs were made at lower evaporator and condenser temperatures.

The refrigerants tested in this work were Refrigerants 12, 13B1, 22, 115, 500 and 502 (the 22/115 azeotrope). In addition, numerous mixtures of Refrigerants 12 and 22 with each other and with Refrigerants 13 and 13B1 were examined.

With any mixture, the refrigerating capacity can be varied from that of the high-boiling component to that of the low-boiling compound. For example, at an evaporator temperature of −10 F and a condenser temperature of 110 F, Refrigerant 12 has a refrigerating capacity of 1,920 Btu/hr in our calorimeter unit while pure Refrigerant 13B1 has a capacity of 5,540 Btu/hr. Any desired capacity between these two values can be obtained by using the proper mixture of the two compounds. Thus, a 25/75 wt per cent Refrigerant 13B1/12 mixture has a capacity of 2,555 Btu/hr while the 65/35 mixture has a capacity of 3,855 Btu/hr.

It is of interest to note that, during steady-state operating conditions, the composition of the gas being circulated is identical with that of the mixture charged to the unit in the first place. It is only on shutdown that separation occurs, with the lower-boiling component being more concentrated in the vapor phase, especially when it also has poorer oil solubility.

THIRD TECHNICAL SESSION—WEDNESDAY, JUNE 28, 9:30 A.M.

Solar heat gains through domed skylights

L. F. SCHUTRUM
Member ASHRAE
Research Supervisor
ASHRAE Research Laboratory

N. OZISIK
Oak Ridge
National Laboratory

Solar heat gains through plastics dome skylights were measured with the ASHRAE Solar Calorimeter under natural weather conditions. The solar properties of the domes were determined analytically from data on flat plastics sheets and were verified by experimentation of domes having high, medium and low light transmitting characteristics.

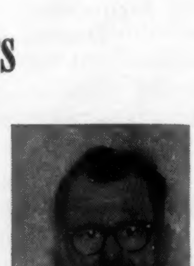
Curbing heights of 18, 9 and 0 in. were used which gave ratios of width of skylight to height of curbing of 5 to infinity.

Solar heat gains are given for the August 1 design day for a number of skylights; and K-factors and U-values are given from which the solar and total heat gains can be found for any location and time of the year.

Air infiltration through revolving doors

L. F. SCHUTRUM
Member ASHRAE
Research Supervisor
ASHRAE Research Laboratory

C. M. HUMPHREYS
Member ASHRAE
Assistant Director of Research
ASHRAE Research Laboratory



J. T. BAKER
Member ASHRAE
Research Engineer
ASHRAE Research Laboratory

N. OZISIK
Oak Ridge
National Laboratory

Air infiltration rates through a motor-driven revolving door were investigated under heating and cooling conditions, by means of the tracer-gas technique. Total infiltration had two components: infiltration related to door speed and infiltration through door cracks. Air-infiltration rates associated with door revolution were separated from the total and given as a function of door speed and indoor-outdoor air temperature difference. An analytical solution was developed to calculate this component. Air infiltration through door cracks was a function of indoor-outdoor pressure difference and the crack size. Traffic patterns and the average door speeds were investigated in the field with manually operated revolving doors, and air infiltration rates corresponding to typical traffic rates were computed.

Evaluation procedure for odor-control methods

WILLIAM F. KERKA
Member ASHRAE
Research Engineer
ASHRAE Research Laboratory

The ASHRAE Research Panel on Odors has long recognized the need for standard procedures to evaluate odor-control methods. As an outgrowth of discussions of this group, numerous procedures were considered; the one ultimately chosen for study is described in this paper. In this regard, it should be emphasized that the following report is primarily an examination of a procedure rather than an analysis of the performance and effectiveness of the odor-control methods themselves. The basic procedure is one of introducing a measured amount of malodor in each of two test rooms, treating one test room with an odor-control agent, and then evaluating the resulting odor levels by sensory techniques with a small group of subjects.

In this study three types of malodors were selected: natural, synthetic multi-component and synthetic single-component. The procedure was applied to three methods of odor control: modification, sorption and oxidation. The pitfalls and problems associated with the procedure are discussed and recommendations made for future improvement. It is hoped that the material presented here will serve as a guide for other experimenters to pursue the problem of evaluating the actual performance of odor-control methods used in air-conditioning systems.

Daily insolation on surfaces tilted toward the equator

BENJAMIN Y. H. LIU
Assistant Professor

RICHARD C. JORDAN
Presidential Member ASHRAE
Professor and Head

Department of Mechanical Engineering
University of Minnesota

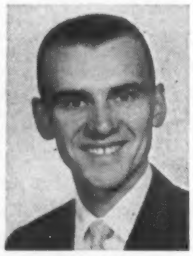
Solar radiation measurements have been made up to this time primarily on horizontal surfaces only; similar measurements on sloped or vertical surfaces are extremely sparse. The solution of engineering and scientific problems involving solar radiation, however, generally requires a knowledge of the solar radiation incident upon surfaces of various orientation. Thus, the large amount of available solar radiation data would be useful to the solutions of these problems only if a method is available whereby horizontal incidence data could be converted to sloped surfaces.

Because of the importance of solar radiation on surfaces tilted toward the equator both from the standpoint of its utilization (solar heat collectors) or its prevention (cooling load), the problem of converting solar radiation data from a horizontal surface to a surface tilted toward the equator is investigated. A method is developed which enables the daily insolation on surfaces tilted at various angles toward the equator to be computed when the daily insolation on a horizontal surface is known. Analytical expressions for the conversion factors for daily direct, diffuse and ground reflected solar radiation are derived and the method for estimating the diffuse radiation is discussed. Application is made to the special case of a vertical surface facing south and the results, when compared with the experimental data of Blue Hill, Mass., have been shown to be accurate to within the uncertainty of the ground albedo at Blue Hill.

JUST WHERE IS THE FROZEN FOOD INDUSTRY HEADED? PAGE 79

FOURTH TECHNICAL SESSION—WEDNESDAY, JUNE 28, 9:30 A.M.

Calculated Temperature Rise in Round Ducts



J. RICHARD WRIGHT
Associate ASHRAE
Assistant Professor
Mechanical Engineering
Tennessee Polytechnc Institute

E. J. BROWN
Associate ASHRAE
Research Assistant Professor
of Mechanical Engineering
University of Illinois

This paper contains temperature rise data for air flow in round ducts for the conditions listed below. The data are based upon calculations using standard heat transfer equations. Data are included for both insulated and uninsulated ducts. The method of analysis is described in detail.

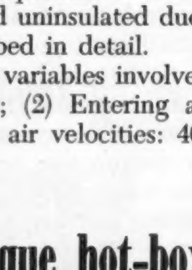
The variables involved were: (1) Duct sizes: 4-8-in. diam; (2) Entering air temperature: 50 F-70 F; (3) Duct air velocities: 400-1200 fpm; (4) Insulation thickness: 0, 1 in., 2 in.; (5) Ambient temperature: 75 F-150 F; (6) Surface emissivity: 0.25 for uninsulated ducts, 0.05 (al. foil) and 0.90 (duplex paper) for insulated ducts.

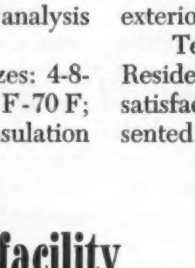
The insulated ducts with an aluminum foil vapor barrier had lower exterior surface temperatures than the same ducts with duplex paper vapor barrier and, therefore, the heat gain to insulated ducts covered with duplex paper was more than the heat gain to insulated ducts covered with aluminum foil. The average increase at 125 F ambient temperature was 16.8 per cent for ducts with 1-in. insulation and 10.9 per cent for ducts with 2-in. insulation.

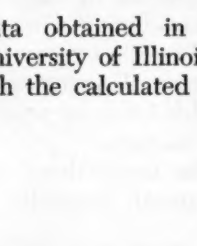
Curves of surface temperatures are presented for use in conjunction with psychrometric data to determine whether condensation will occur on the exterior surfaces.

Temperature rise data obtained in Research Residence No. 2 at the University of Illinois were in satisfactory agreement with the calculated data presented here.

A unique hot-box cold-room facility







W. P. BROWN

K. R. SOLVASON
Member ASHRAE

A. G. WILSON
Member ASHRAE

Building Services Section, Division of Building Research, National Research Council of Canada

A detailed description is given of a unique guarded hot box used in conjunction with a large cold room for the measurement of heat transmission coefficients of building sections at conditions closely simulating those used for design calculations. The metering area of the box is 4 by 8 ft and walls up to 12 ft long can be installed. It is shown that inside surface conductances provided by the apparatus are similar to those that occur in practice under natural convection conditions.

Relationships describing the radiant and convective components of the inside surface conductance, applicable to most test sections, have been determined for the box. Using these relationships, average inside surface temperatures and thermal conductances of non-uniform walls can be calculated.

Realistic outside surface conductances are also provided. Results of studies made on heat leakage errors are presented and discussed. It is shown that edge heat leakage at the junction of the hot box edge construction and test wall is small and that good over-all accuracy is obtained.

CORRECT APPLICATION OF PRESSURE DROP CURVES TO MTW SYSTEMS IS ESSENTIAL TO DESIRED HEATING SYSTEM PERFORMANCE. PAGE 42

Integrated load technique for estimating annual energy use of central air-conditioning plants

A. EUGENE CONGRESS
Head,
Air Conditioning and Research Section
Power Generation Branch
Bureau of Yards and Docks
Department of the Navy

This paper is concerned with the problem of deciding which of several refrigeration equipment methods should be selected to air condition a 5-million dollar addition to a large naval hospital. It deals with the difficulties of estimating operating costs of 5 different schemes, ranging from the all-electric centrifugal compressor to straight steam absorption and their combinations.

For the purpose of equipment selection, the differential cost method is utilized; that is, how much extra money would each of the different equipment schemes cost over and above the existing level of operations.

Although the paper discusses the factors of incremental maintenance and operation, and effect on boiler plant operations, the major emphasis is on energy cost. This is evaluated on a common basis of hours of operation at 8 different system loads, derived from U. S. Weather Bureau dry bulb temperature data. Typical curves of power input vs. system load are illustrated, and the annual energy consumption of 2 of the 5 schemes is presented both in detailed calculations and in the graphical form of integrated load duration curves, where areas under the curve represent total annual energy input chargable to the refrigeration machine. The results of the study of all 5 equipment schemes are presented in tabular form giving quantities of energy and water consumption, and comparative annual costs.

Sample calculations convert annual savings to present capital worth in order to compare with initial capital costs of alternate equipment.

Data developed from the load duration curves are expressed in equations to yield annual electricity or fuel consumption, ton-hr of refrigeration, equivalent full-load refrigeration or energy hr, Btu cooling tower load and cooling tower water makeup.

The correct unit utility price to be used in calculating energy costs is discussed. A cost-trend graph comparing the annual energy operating cost of electricity vs. fuel oil is presented for 2 of the schemes for the period 1950-1960 projected to 1970. It shows that for the period 1950-1960 the trends in energy costs moved side by side. On the basis of 1960 unit energy prices, the system employing turbine-driven chilled water and condenser water pumps exhausting to absorption machine, and the system employing the combination turbine-driven compressor exhausting to absorption machine proved to be the most economical. The turbine-driven compressor design was the most costly.

Finally, the indiscriminate practice of estimating annual energy consumption by the use of equivalent full-load hr is challenged. It is shown that different types of refrigeration equipment doing the same job may have different equivalent full-load energy hours.

INDUSTRIAL VENTILATION SYMPOSIUM—MONDAY, JUNE 26, 9:30 A.M.

Laboratory Hood Design

ROBERT JORGENSEN
Chairman
Member ASHRAE
Assistant Chief Engineer
Buffalo Forge Company

J. C. BURKE, JR.
Associate ASHRAE
Head of Mechanical Engineering
Tracy-Behrent

Basic Requirements of Laboratory Hoods

Basic requirements of laboratory hoods, including criteria for toxic fumes, objectionable odors and other significant factors will be covered, together with a discussion of the economics of hood design.

Design of Hoods

E. J. WILLIAMS
Member ASHRAE
Supervisor-Mechanical Engineering
Abbott Laboratories

Design of hoods which incorporate a supply of unconditioned air down the face of the hood will be described, as well as the economics of their use in air conditioned laboratories.

Materials and Construction

T. B. LANAHAN
Chief Engineer
S. Blickman, Inc.

Construction features of hoods and various materials that are available will be outlined. Advantages and economics of the selection of a material will be brought out.

History of the Use of Fume Hoods

G. T. SAUNDERS
Manager, Scientific Equipment Div
Kewaunee Mfg. Co.

L. N. NELSON
Head, Engineering Dept.
Kewaunee Mfg. Co.

Beginning with a brief history of the use of fume hoods, this discussion will consider the factors determining face velocity. A movie demonstrating hood effectiveness will be included.

AIR CONDITIONING SYMPOSIUM—MONDAY, JUNE 26, 9:30 A.M.

Window Units or Central Systems?

W. R. MOLL
Member ASHRAE
Chairman
Sales Manager
Air Conditioner and Dehumidifier
Sales-to-Sears
Whirlpool Corporation

A major controversial problem of present-day design will be discussed at the Air Conditioning Symposium. Shall we use window units or a central system for residential applications? A hypothetical situation in a residence located in a warm, humid climate – such as a river town in the midwest – will be considered by industry representatives. The Symposium will develop from a debate on the problematical installation, with ample time for questions and comments from those attending.

FOOD REFRIGERATION SYMPOSIUM—TUESDAY, JUNE 27, 9:00 A.M.

Use of Liquefied Gases for Low Temperature Food Handling

AARON L. BRODY
Associate ASHRAE
Product Development Manager
M & M Candies
Chairman

The history of food preservation by virtue of low-temperature retardation of enzymatic, biochemical and microbiological activity in foods has demonstrated a logical progression from use of naturally-cool caves and underground depths to snow and ice to man-made ice and finally to the present widely applied man-made refrigeration. While today's mechanical, absorption and thermoelectric devices for removing heat from food environments have made available more and better food than ever before in man's history, the less than universal application of these systems for various technological and economic

reasons has been partly responsible for the lack of predicted expansion of the frozen and fresh food industries since World War II. This contention, coupled with recent legislative activity attempting to regulate quality of frozen and fresh foods rather than the prior mere enforcement of food safety, has prompted the recent entry into the field of food refrigeration of the use of liquefied gases as cooling and blanketing agents for food handling. Such activity has been accelerated by the availability of large quantities of relatively inexpensive liquefied and solidified gases in recent years.

Much has been written and spoken of the place of such gases in the low-temperature food handling system of this nation. This Symposium, the second in a series sponsored by ASHRAE's Food Technology and Refrigeration Panel, is the first known effort to gather together experts from all phases of industry, government and the academic world to discuss the many and varied facets of the use of liquefied gases for low-temperature food handling. The objective is to isolate all pertinent factors and to integrate them in an effort to remove all conjecture from this controversial subject. The speakers have been carefully selected to represent both pros and cons of the subject; from their papers, it is certain that, while all the answers may not be forthcoming, numerous questions will be posed.

The Role of Liquefied Gases in the Frozen Food Field

KIRBY M. HAYES
Associate Professor
Department of Food Technology
University of Massachusetts

Under present-day conditions, the movement of frozen foods from the packing plant to the retail store is characterized by wide variation in temperature. While today's transportation and handling methods differ to some degree from those used previously, adequate temperature protection for frozen foods is still lacking in certain areas. Emphasis on quality has been and is increasing due to time temperature tolerance studies of the USDA, industry group action, state regulations and chain store enforcement. Work done in Massachusetts and other states shows that quality-protecting temperatures are not normally maintained during transportation, while plant surveys show that production rates at times tend to overburden freezing facilities.

At the present time, liquefied gases appear to be economical and versatile enough to offer solutions to many of these problems. Quality maintenance through temperature control can be provided with liquefied gas systems, and at a temperature level equal to or lower than code requirements. Although refinements in the systems will be made, liquefied gases will have an important future role in the frozen food field.

Relative Merits of Various Gas Liquefying Cycles for Use in Freezing and Transportation of Foods

SAMUEL C. COLLINS
Member ASHRAE
Professor
Dept. of Mechanical Engineering
Massachusetts Institute of Technology

In the freezing of food by contact with liquid nitrogen or other liquefied gases, it is generally inconvenient or impossible to use directly the refrigerative power of the cold vapor. Various methods of avoiding this loss will be discussed.

Effects of Ultra-Low Temperatures on Foods

WALTER A. MACLINN
Member ASHRAE
Director
The Refrigeration Research Foundation

Liquid gases have been used successfully in the cooling of air temperatures around loads of frozen foods in vehicles of transportation. When handled properly, there is little evidence of damage. However, the complete freezing of biological materials at the ultra-low temperatures of liquid gases presents problems not yet answered by science, relative to their mode of handling in the marketing channels. A review of the knowledge pertaining to the freezing of tissues, as seen at the molecular level, and the gaps of knowledge pertaining to the handling of ultra-low temperature frozen foods, will be detailed.

Commentary

V. J. JOHNSON
Member ASHRAE
Chief
Cryogenic Data Center
National Bureau of Standards
U. S. Dept. of Commerce

Multi-Stop Delivery of Frozen Foods Using Liquid Nitrogen Refrigeration

J. J. KANE
Project Engineer
Cryogenic Products Development Dept.
Linde Co.
Div. of Union Carbide Corp.

As frozen foods move from the packer to the consumer, they are transported several times with intermediate storage at warehouses. The final transportation step to retail stores and institutions suffers from a lack of inventory space at these establishments. As a result, the outlets order LTL type shipments several times a week. In order to make this transportation step economically attractive, the trucker must deliver to a number of such outlets in a single truck loading. The refrigerated truck may stop and deliver frozen food at from 8 to 40 such outlets in any one day. This repeated open door exposure of 0 F frozen food to ambient temperatures as high as 100 F adds a severe heat load to the refrigerating system. In addition, the stop and go nature of the operation normally precludes the possibility of the refrigeration system reestablishing the necessary 0 F environment.

A system using liquid nitrogen as the primary refrigerant for this severe transportation area has been developed and is in commercial use. This paper will present a description of the equipment and its capabilities.

Use of Liquefied Gases for Freezing and Shipping of Goods

ROBERT C. WEBSTER
Manager
Customer Service Laboratory
Air Reduction Sales Co.

Commentary

IRVING J. PFLUG
Member ASHRAE
Professor
Dept. of Food Science
Michigan State University

Truck and Rail Car Pre-Cooling and Post-Cooling with Carbon Dioxide

JOHN P. ANTOLAK
Director
Carbon Dioxide Technical Sales
Liquid Carbonic Div.
General Dynamics Corp.

More than ever, in the past few years attention has been paid to retaining product quality in perishable foods. Handling procedures are closely and critically watched by shippers, suppliers and retailers. The industry, of its own initiative, has made remarkable advances in various phases of operation to assure that undesirable high temperatures are not reached.

Carbon dioxide was found to be beneficial in pre-cooling and post-cooling equipment used in transporting these perishables: Carbon dioxide is injected into the car or trailer to supply a high refrigeration capacity to quickly reduce temperatures to desirable levels. Various forms of carbon dioxide and methods of use in pre- and post-cooling will be discussed.

DOMESTIC REFRIGERATOR ENGINEERING SYMPOSIUM
—WEDNESDAY, JUNE 28, 9:30 A.M.

Organizing for Quality

E. J. VON ARB
Chairman
Member ASHRAE
Vice President
Director of Engineering
Revco, Inc.

Product quality has become more than just desirable – it is a necessity and achieving it has become the first requisite of effective corporate leadership.

Product quality begins with design, which does not mean merely styling. The manufacturer has a continuing responsibility for emphasis on design improvements that result in more efficient performance, eliminating service problems.

Like most desirable goals, this is easy to describe but a great deal harder to obtain. This Symposium will relate product quality, quality control and product reliability.

Total Quality Control

WILLIAM J. MASSER
Manager of Quality Control
Engineering Service
General Electric Co.

If present trends continue, the businessman is going to be dealing with an increasingly demanding customer. Product quality is coming to have a high priority among the factors which induce industrial and individual consumers to choose one brand over another. Furthermore, as our technology continues to mature, technical specifications become more and more rigorous. Precision measurements and rigid analyses of size, shape, color and other qualities are becoming standard procedure in manufacturing firms.

These developments are paralleled by rising quality control costs. Charges for equipment and manpower are part of the story; the expense of adjustments is another part. Automation, with its dependence on smooth-flowing, high-volume output, is going to aggravate the problem still further. This problem – the accelerating demand for quality and the mushrooming costs of quality control – will be discussed.

Quality Control in Operation

Beginning with a discussion of quality and quality control, organization will be considered also – where quality control should fit, organization for the quality control function and relation of quality control to other functions.

Another phase – quality control functions, as a guardian of quality reputation, as a quality communication center, measuring quality and controlling quality – will be covered.

Additionally, quality control responsibilities and authorities and their relation to production, shipment of product and design will be brought out.

Final aspect to be discussed is the acceptance of the quality control concept by management, by manufacturing, by engineering and design and by marketing.

R. D. SONDERUP
Manager
Quality Control
Appliance Operations
Philco Corp.

Keynote Address

MORRIS KAPLAN
Technical Director
Consumers Union

Relationship of Cost Reduction vs. Quality

In tracing the historic and paradoxical relationship of cost reduction vs. quality, patterns in engineering education, product development, and marketing during the 1920-1960 era will be reviewed.

Attention will be focused on the impact of changing social needs and cultural values. In conclusion, a philosophy for engineers will be presented.

WILLIAM E. MAHAFFAY
Member ASHRAE
Vice President of Engineering
Whirlpool Corp.

FORUMS

R. S. BUCHANAN
Chairman
Member ASHRAE
Assistant Director
of Appliance Engineering
and Research
American Motors Corp.

Forums offer highly informal discussions for the exchange of ideas. There are no prepared papers or talks, no notes or minutes are taken, it is all "off the record." Our guests of the press respect the spirit of the Forum. Here is an excellent opportunity to exchange and discuss ideas and opinions.

Seven diversified subjects will be covered at the ASHRAE 68th Annual Meeting in Denver. These were selected on the basis of popular interest expressed from various sources. The Forums to be presented, and their moderators, are shown elsewhere.

(*Continued on page* 100)

A Legal Review of the Board's action on

R. H. TULL
President
ASHRAE

The decision of the Board of Directors to adopt the recommendations of the Long Range Planning Committee with regard to the Society's future research program was reported to the members in the January, 1961, issue of the JOURNAL. Since that announcement, some objections to the action have been voiced by some members. Several questions have been asked regarding the legality of the Board's action. The raising of such questions is entirely right and proper, and I believe the answers to these questions will be of interest to all the members.

On April 20, I asked Executive Secretary R. C. Cross to have the Society's legal counsel, Stephen B. Vreeland, make a legal review of all matters relating to this action and to give his legal opinion on the following specific points:

1. The legality of the Board's action in view of:

STEPHEN B. VREELAND
Attorney and Counsellor at Law
10 East 40th Street
New York 16, N. Y.

April 26, 1961

Mr. Robert C. Cross, Executive Secretary,
American Society of Heating, Refrigerating and Air-Conditioning Engineers
234 Fifth Avenue
New York 1, N. Y.

Re: ASHRAE—Termination of Research Laboratory in Cleveland

Dear Bob:

Pursuant to our telephone conversation of last week, I write you this letter based upon:

The Certificate of Consolidation of ASHAE and ASRE;
The By-Laws of ASHRAE as twice amended;
The report of the Long-Range Planning Committee dated December 1, 1960;
Minutes of the Board of Directors of December 9, 1960, with attached letter dated December 7, 1960 and appendix thereto of Mr. Palmatier and letter from Mr. Jennings to Mr. Grant of December 6, 1960 and two exhibits attached;
Article of Mr. Grant on page 54 of the January 1961 Journal;
Letter from John H. Clarke to Mr. Grant dated January 30, 1961;
Program of Semi-annual Meeting in Chicago, February 13-16, 1961;
Form of petition to Board of Directors, dated February 13, 1961;
Letter from Mr. Tull to signers of petition, dated February 21, 1961, with copy of letter to Mr. John H. Clarke of same date;
Copy of letter from Mr. H. T. Gilkey to Mr. Tull, dated March 7, 1961;
Copy of letter from Mr. Gilkey to Mr. Tull dated April 6, 1961;
Copy of telegram from Mr. Clarke to Mr. Grant of April 18, 1961;
Proposal between ASHRAE and Kansas State University dated April 10, 1961;
Letter from Mr. Clarke to me dated April 22, 1961, with a copy of his letter to Mr. Cross of the same date;
The Plan for Merger of ASHRAE and ASRE and particularly part III, page 3, regarding research.

From the foregoing and my conversations with you, I have come to the following conclusions:

1. Under general corporate law of the State of New York, the directors of any corporation have the right to conduct the business and affairs and fix the policies of the corporation.
2. This power must be exercised in good faith and with reasonable, prudent judgment.
3. The By-Laws of ASHRAE in Section 5.3 provide that "The Board of Directors shall have full and complete management and control of the activities, properties and funds of the Society, subject to the provisions of law, the Certificate of Consolidation and the By-laws." The said section also provides: "The Board of Directors may, in its discretion, refer to the Society any important question pertaining to the Society, and shall refer any such questions to the Society upon a majority vote taken at a stated or Special Meeting of the Society."
4. Section 8.8.1 of the By-laws, as amended, provides that the Executive Committee shall investigate and make reports and recommendations to the Board of Directors and that during intervals between Board of Directors' meetings the Executive Committee shall exercise administrative powers of the Board of Directors but that matters of policy determined by the Executive Committee between meetings of the Board of Directors shall be submitted to the Board of Directors at its next meeting for ratification.
5. Section 8.8.23 of the By-laws of the consolidated Society provides (up to the time of the amendment on February 13, 1961, which amendment is immaterial for our present purposes) that "the Research and Technical Committee, subject to the direction of the Board of Directors, shall conduct and co-ordinate basic research and technical studies * * *."

It appears that all activities of the Research and Technical Committee are subject to review by, and action upon the part of, the Board of Directors.

6. When the petition signed by over 50 members was brought before the Board of Directors on February 16, 1961, the Board deliberated and by a majority of 3 to 1,

on the Research Program

(a) The merger and disposition of the assets of one of the predecessor societies.
(b) Lack of support of the recommendations of the Long Range Planning Committee by the Research and Technical Committee.
(c) Rejection of the referendum petition by the Board.
(d) Subsequent actions toward disposing of the laboratory following rejection of the referendum petition.

2. The personal liability of the individual Board members and officers of the Society who were a party to the Board's decision and subsequent actions.
3. The legal requirements on the Society to publish material regarding this matter if requested by a member.
4. The actions of the Board and Executive Committee related to the Kansas State University proposal.
   (a) Is a legal contract necessary covering all details?
   (b) What is ASHRAE's responsibility to Kansas State University in case of a delay caused by court action on this subject?
5. The basis for an injunction.
   (a) What would be required to comply if an injunction is granted?
6. What action is legally required regarding the Savannah, Georgia, resolution?

Counsel Vreeland's statement will, I am sure, answer questions that may have been in the minds of some members. I urge you all to read it as reproduced, in full, herewith.

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denied the petition. It was also the unanimous consent of the Board that in the best long-range interest of the Society the Cleveland Laboratory should be discontinued. Therefore, the Board, in its discretion, decided the matter should not be referred to the Society as provided in Section 5.3. If a motion had been made at a stated or Special Meeting of the Society a majority vote would have required the submission of any questions raised to the members. This, however, was not done.

It would appear, therefore, that the Board of Directors acted in accord with the provisions of the By-laws.

7. The Agreement for Consolidation, dated October 18, 1958 contains no mention whatsoever of the matter of research except in paragraph VI (b) in which, under the heading of "The terms and conditions of consolidation, in addition to those hereinabove set forth, and the mode of carrying the same into effect are as follows:"

"(b) to encourage and conduct scientific research and the study of principles and methods in the fields of heating, refrigeration and air-conditioning and ventilation, and the allied arts and sciences, the results of which shall be made freely available to the public."

Nowhere is any mention made as to the maintenance of a research laboratory or any similar facility, nor as to the mode of carrying that provision into effect.

8. The monumental report of the Long-Range Planning Committee, dated December 1, 1960, consisting of 32 pages of text and probably approximately the same number of pages of appendices and documentation, appears to me to set forth all of the arguments both pro and con on the question of termination of the research laboratory in Cleveland. The two prime recommendations of that Committee (page 2) are that the Society "continue a vigorous research program" and "discontinue the Society Laboratory at Cleveland and dispose of it as soon as practicable." It is my opinion that any reasonable person reading this study would have come to the conclusion that its recommendations were arrived at after mature, keen business judgment and in the utmost good faith.

It is true that some persons might disagree with the recommendations but so far as I have heard, there is no dispute of any matter of fact set forth in the study. It is also true that two persons, upon the same and identical facts, may arrive at different conclusions but where each of them has exercised reasonable prudent judgment and good faith neither of them can be accused of being derelict in his duty or remiss in his obligations, and is therefore legally blameless.

9. In the minutes of the Special Meeting of the Board of Directors held on December 9, 1960, which meeting was called for the sole purpose of discussing the foregoing study of the Long-Range Planning Committee, it appears that the Board of Directors discussed the matter at great length from 9 a.m. until 3:45 p.m. and, after deliberation, voted 17 to 1 to adopt the recommendations made in the study.

I further understand that the Research and Technical Executive Committee agreed with the recommendation that the laboratory be discontinued at once but that the Society should continue research by other means.

It appears that the determination made at the Special Meeting of the Board of Directors on December 9, 1960 was promptly reported to the members as appears on page 54 of the January 1961 issue of the Journal.

Furthermore, it appears that a complete discussion of the matter of research was held in a symposium at the February semi-annual meeting of the Society.

10. At the semi-annual meeting on February 13, 1961, a petition requesting "that a referendum be taken to determine the desires of the membership with respect to continuing or discontinuing the facilities at Cleveland" was presented and the same was discussed at a meeting of the new Board of Directors on February 16, 1961, and by a majority of 3 to 1 the said petition was denied and it was the unanimous agreement that the Society discontinue the operation of the Cleveland Laboratory.

11. After such determination by the Board of Directors the Executive Committee has proceeded to administer the same and has authorized the proper officers of the Society to proceed with a termination of the operation of the laboratory. The employees have been notified of the termination of their services and many of them have already obtained new positions. Arrangements have been instituted regarding the disposal of some of the equipment. Other matters in connection therewith are also being attended to.

My conclusions are as follows:

A. The Board of Directors, having in law and under the

By-laws complete management and control of the activities, properties and funds of the Society, were empowered to determine the continuance or discontinuance of the research laboratory, and this determination was arrived at in what, in my opinion, amounts to the exercise of good faith and prudent judgment.

B. The Board of Directors was not required to direct a referendum of the members inasmuch as the Board under the By-laws is only required to do so, in its discretion, on any important question. This Board, in its discretion, decided no referendum should be had and that determination, in my opinion, was legally arrived at.

C. If the members had desired to compel a referendum they could have done so by a majority vote taken at the meeting of the Society in Chicago, under the provisions of Section 5.3 of the By-laws. No motion to that effect was made and therefore no vote was taken.

Herewith are my conclusions in answer to the questions of Mr. Tull in his letter to Mr. Cross of April 20, 1961.

1 (a) Upon the consolidation of two New York membership corporations, such as ASHAE and ASRE, "all rights, privileges and interests of each of the constituent corporations and all property, real, personal and mixed, and all debts due on whatever account to any of them and other things in action belonging to any of them, shall be deemed to be transferred to and vested in the consolidated corporation without further act or deed. * * * ." (Section 53, Membership Corporations Law).

The consolidated corporation (in this case ASHRAE) has the right to make all dispositions of the properties and assets which it has received from the constituent corporations.

1 (b) Lack of support by the Research and Technical Committee may have some argumentative value but is not conclusive in view of the fact that under Section 8.8.23 of the By-laws that Committee is subject to the direction of the Board of Directors and, of course, the latter may either agree or disagree with the Committee.

1 (c) Refusal of the referendum request. I believe that is answered in paragraphs A, B and C above.

1 (d) The Society has a perfect right at present to proceed to dispose of the Laboratory, its contents and any matters pertaining thereto. The request for a referendum does not legally enjoin the Society from proceeding with its own decision made through its Board of Directors to dispose of the same.

2. Under the facts and documents submitted to me I am of the opinion that a court would not hold personally responsible or liable any of the members of the Board of Directors or officers of the Society on the ground that each of them has acted upon a determination legally made by the Society arrived at in good faith and in the exercise of prudent judgment.

3. It is my opinion that there is no legal requirement that the Society publish in the JOURNAL material regarding this controversy. I believe that the Board of Directors, Executive Committee or officers of the Society might well determine that such publication would constitute unreasonable use of the Society's funds. The situation seems to me to be similar to that of stockholders in a proxy fight against management. The management is entitled to pay reasonable expenses to oppose the dissenters out of the funds of the corporation so long as the corporation's directors and officers are acting in good faith and with prudent business judgment. On the other hand, the dissenters are required to pay the expenses of their own propaganda and can only be reimbursed from the corporation's funds under certain circumstances where the dissenters are the victors in the controversy.

4. I see no reason why the Board, Executive Committee and officers should not proceed with the negotiations respecting the Kansas State University proposal.

4 (a) The matter should certainly be covered by a sufficiently broad legal contract.

4 (b) If there be a court fight on this subject and the disposition of the Laboratory and its contents is stopped or delayed, Kansas State University might have a claim against the Society but this can be prevented by a proper exculpatory clause in the contract between the Society and the University.

5. An injunction is usually granted only at the time of or after an action is instituted and it is only in one case in a thousand that a preliminary injunction is granted and then only upon notice to the defendant and an opportunity to oppose the same.

5 (a) In my opinion no court would grant an injunction sufficiently broad as to enjoin *ex post facto* any actions of the Society done under what was at the time a legal determination.

6. In my opinion, the resolution of the Savannah Chapter can be considered by the Board of Directors in the same light as the petition presented to it in Chicago and is entitled to the same method of procedure. I believe that the resolution should be brought before and discussed at the next scheduled meeting of the Board of Directors unless, of course, the Board itself feels that the matter is of sufficient importance to justify the calling of a Special Meeting of the Board.

Knowing as I do many of the officers and directors of the Society and from my contacts with them having formed a very high opinion of their sincerity, integrity, interest in the welfare of the Society and its members, and their high degree of business acumen, and the facts, mostly documented, which have been presented to me in connection with this matter, I can only come to the conclusion that if this matter is ever litigated, which I understand has been threatened, such a proceeding would result only in substantial expense and ill-feeling without any probability of success on the part of those now complaining.

Very truly yours,

Stephen B. Vreeland

STANDARDS PAGE

Heavy Duty Furnace Standard

A. T. BOGGS, III
ASHRAE Technical Secretary

It is the practice of the ASHRAE Standards Committee to request comments from the membership on proposed revisions to existing standards or on the need for a new standard covering specific devices. The Society standard covering **heavy duty furnaces and direct-fired unit heaters** was developed by a standards project committee of ASHAE and adopted by the Society in 1955.

Recent contact between the Standards Committee and representatives of the group that developed the original standard indicates that the present edition of this standard is adequate for industry application. The Standards Committee is requesting comment from the many members in ASHRAE who are active in the fields covered by this standard and it would be appreciated if comments could be received concerning the present standard or suggested additions or corrections for a revision. Review copies will be sent to those interested by the technical secretary.

ARI: A new edition of the ARI Directory of **Certified Unitary Air-Conditioners** has recently been is-

sued. This directory carries certified ratings on more than 2700 units of 53 manufacturers and is effective through July 31. Copies may be obtained gratis by writing to Air Conditioning and Refrigeration Institute, 1346 Connecticut Avenue, NW, Washington 6, D. C.

ASA: On April 11 a general conference at ASA recommended that projects be established in the fields of **dimensional metrology** and the **calibration of measuring systems.** The metrology project would include the inspection and means of measuring characteristics of geometrical configurations. A similar study for the calibration of measuring systems would include terminology and calibration standards for various measuring instruments. ASME has been named to serve as administrative sponsor of these activities.

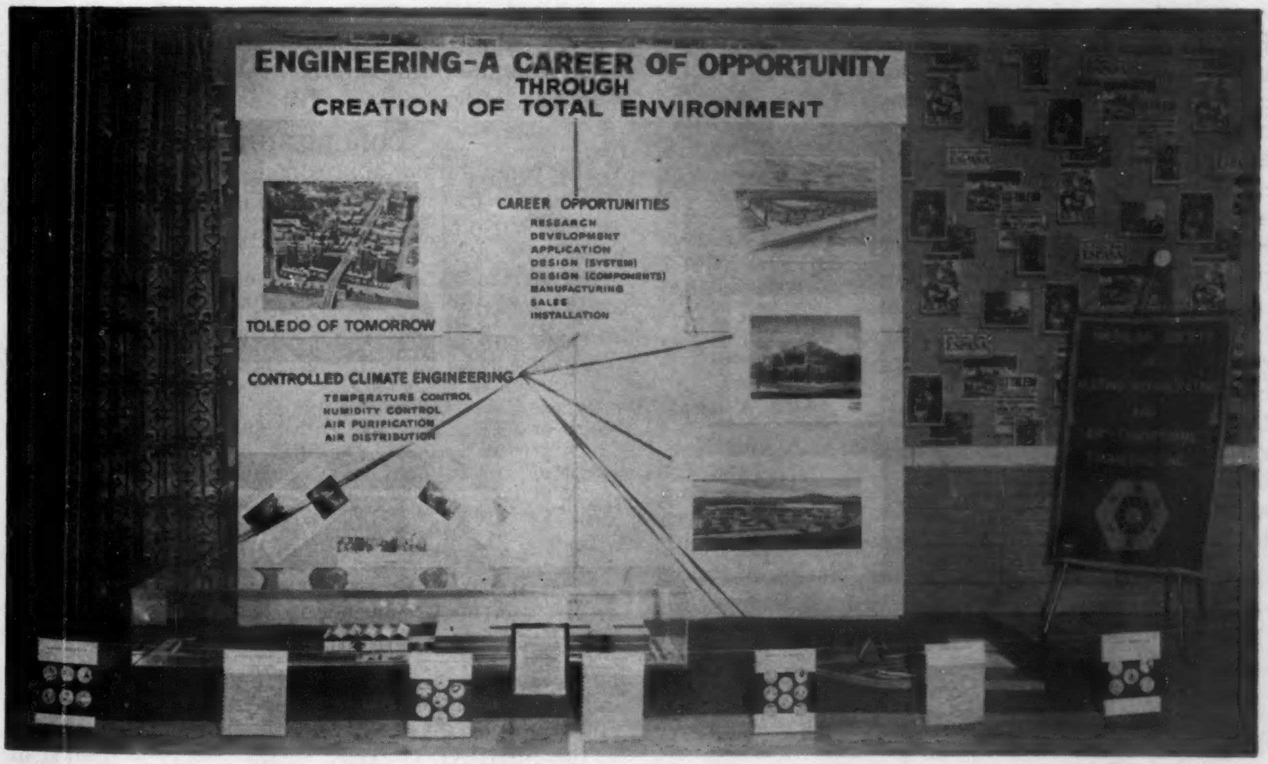
Catalog Available—The 1961 catalog of American Standards is available without charge from American Standards Association, 10 East 40th Street, New York 16, N. Y.

GOVT: Proposed TFE Standard—The first of a series of standards for TFE-fluorocarbon resins is now being considered by industry for adoption, according to the Department of Commerce. This proposed standard establishes requirements and methods of test for the material, dimensions, workmanship, and the physical and electrical properties of three grades of TFE sheet furnished in minimum thicknesses of 1/32 in.

After sufficient endorsements are received from representative manufacturers, distributors and users, it will be published as a voluntary standard of the trade. Copies of the standard, entitled **Recommended Commercial Standard for TFE-Fluorocarbon Resin (Polytetrafluoroethylene) Sheet, TS-5528,** are available on request from the Commodity Standards Div, U. S. Department of Commerce, Washington 25, D. C.

New **Particleboard Standard**—The Department of Commerce has announced availability of a new **Commercial Standard CS236-61** for **Mat-Formed Wood Particleboard (Interior Use).** The standard will be effective for new production from June 1, 1961. The National Particleboard Association is considering the possibility of expanding this basic standard to cover specific use of standards for floor underlayment, core-stock for plywood, and for exterior sheathing. Copies will be available from the U. S. Government Printing Office, Washington 25, D. C.

FIRST PRIZE TO TOLEDO CHAPTER



First place went to the ASHRAE Chapter for this window display dramatizing the fields of ASHRAE as a career of opportunity. Each year, during Engineers Week, the Engineering Society of Toledo sponsors a program whereby various engineering societies in the Toledo area compete, by preparing a display and presenting it in a downtown store window. These displays depict the theme of Engineer's Week. This year the theme was "A Career of Opportunity."

Fourteen societies competed for this award.

The window display committee responsible for the award included: Orlin Hockin, (Associate), M. D. Williams, (Affiliate), and Clyde Stoneking, (Associate).

Thinner walls for

More Refrigerated Space

There are two ways to increase the useful capacity of a refrigerator. One is increasing the outside dimension. The other is by reducing the wall thickness of a cabinet. This can be done by using insulation with higher thermal efficiency—such as high density fibrous glass, bagged insulation or polyurethane foam.

Several speakers at the ASHRAE Domestic Refrigerator Engineering Symposium at the Chicago Semiannual Meeting, February 13-16, covered this comparatively recent development.

Here, in summary, are the most important points emphasized.

What thin wall thickness may be specified for domestic refrigerators and freezers?

SEVERN JOYCE
Associate ASHRAE

EUGENE B. FRANKENHOFF
Affiliate ASHRAE

MARION HOLLINGSWORTH

Reported herein are results of the initial phases of a study of minimum wall thicknesses in domestic refrigerators and freezers. Refrigerator manufacturers have been exploring thin-wall construction and the question has arisen as to what is the minimum thickness possible with different insulations of various thermal conductivities. In this study, only heat transfer perpendicular to the surface was considered. Heat transfer around the throat area was not investigated. The design criterion was that no condensation should occur at 90 F and 85 per cent relative humidity. The three phases covered by this paper are:

A. Computed minimum wall thickness, under certain design criteria for various facings and insulation systems. The insulation systems considered were air filled fibrous glass, heavy gas filled plastics foams, heavy gas filled fibrous glass and fibrous glass supported vacuum. The facings considered were 0.030-in. painted steel.

B. Experimental confirmation of published surface coefficients of heat transfer used in the computations for part A.

C. Experimental confirmation of the computed results obtained in part A for walls constructed of air filled fibrous glass faced on both sides with 0.030-in. steel painted on the outer side with 3 mil of white lacquer.

Experimental confirmation is planned of the results computed for several of the other insulation systems.

CONCLUSIONS

1. By computation, approximate minimum total wall thicknesses for various insulation systems with two painted 0.030-in. steel facings appear to be:

Refrigerators at 38 F and 50 fpm air velocity	
k of 0.22 to 0.23*, air filled fibrous glass:	1.3 in.
k of 0.12 to 0.16*, gas filled foam:	1.0 in.
k of 0.10 to 0.11*, gas filled fibrous glass:	0.7 in.
k of 0.04 to 0.06*, fibrous glass supported vacuum:	0.4 in.
Freezers at —5 F and 50 fpm air velocity	
k of 0.21 to 0.22*, air filled fibrous glass:	2.4 in.
k of 0.10 to 0.15*, gas filled foam:	1.7 in.
k of 0.09 to 0.10*, gas filed fibrous glass:	1.2 in.
k of 0.04 to 0.05*, fibrous glass supported vacuum:	0.6 in.

*Listed k of materials at 65 F mean for refrigerators and 42.5 F mean for freezers (Btu/hr/sq ft/in.F).

2. By experiment, the results of the first construction (air filled fibrous glass with painted steel facings) are conrmed.

3. The convection heat transfer at high air velocities appears to be greater than anticipated from formulas in the ASHRAE GUIDE. More testing is needed to explore this area and confirm the validity of this conclusion.

DISCUSSION

Determination of minimum wall thicknesses by calculation. Design criteria selected were the prevention of condensation under conditions of 90 F and 85 per cent R.H. The dew point for these conditions is 84.8 F. A surface temperature of 85.0 F was assumed adequate to prevent condensation. Following

Severn Joyce is Manager, Appliance and Equipment Sales, Owens-Corning Fiberglas Corp.; Marion Hollingsworth, Jr. and E. B. Frankenhoff are also with Owens-Corning. This paper was presented as "Wall Thickness Studies for Domestic Refrigerators and Freezers" at the Domestic Refrigerator Engineering Symposium at the ASHRAE Semiannual Meeting in Chicago, February 13-16, 1961.

is the procedure by which the minimum wall thicknesses were computed.

1. Determine the heat gain by natural convection and by radiation in a 90 F ambient to the outer surface panel at 85 F.

By convection: Conductance for natural convection heat gain of a flat vertical surface is found[1,2] to be approximately 0.4 Btu/hr/sq ft/F difference between the panel surface and surrounding air. Therefore, total loss is 0.4 (90 F − 85 F) or 2 Btu/hr/sq ft.

By radiation: Gain by radiation is equal to the product of the Stefan Boltzmann radiation constant (γ), the effective emissivity (ε) and the difference in the fourth powers of the absolute temperature.[3]

$$\begin{aligned}\text{Btu/hr/sq ft} &= \gamma\,\varepsilon\,(T_1^4 - T_2^4)\\ &= 1730 \times 10^{-12} \times .9 \times [(90+460)^4 - (85+460)^4]\\ &= 5.4\end{aligned}$$

Therefore the total loss is 2 + 5.4 or 7.4 Btu/hr/sq ft. It should be noted that about two-thirds of this loss is due to radiation. At these temperatures, the color of the surface should not change appreciably the emissivity or alter the heat gain. It should be noted that this is a constant heat gain dependent on panel surface conditions and a temperature difference of 5 F. Therefore it can be utilized for both refrigerators and freezers.

2. Determine the inner cold surface (liner) temperature which results in the same heat gain, 7.4 Btu/hr/sq ft, by the sum of convection and radiation. To simulate temperatures of a home freezer, a temperature of –5 F was selected. In the case of the food compartment of a refrigerator, 38 F was chosen. It is assumed that air circulation induced by fans will have velocities from 50 to 500 fpm. Again from literature,[4] it can be deduced that convection conductance increases about 0.245 Btu/hr/sq ft/F for each mph increase in velocity. Thus, for 50 fpm (0.568 mph) and 500 fpm (5.68 mph), the increase in conductance is 0.14 and 1.4 Btu/hr/sq ft/F, respectively. The total convective conductance is:

for 50 fpm = 0.4 + 0.14 = 0.54 Btu/hr/sq ft/F
for 500 fpm = 0.4 + 1.4 = 1.8 Btu/hr/sq ft/F

Radiation losses were determined for the cold surface, assuming surrounding air at –5 F for home freezers and 38 F for refrigerators.

Determination of the surface temperature necessary to give a total loss of 7.4 Btu/hr/sq ft (by the sum of radiation and convection) is a cut and dry procedure. By this process, the following surface temperatures were found to give 7.4 Btu/hr/sq ft total loss.

Freezer at 50 fpm: +1.7 F
Freezer at 500 fpm: —1.9 F
Refrigerator at 50 fpm: 43.5 F
Refrigerator at 500 fpm: 40.8 F

This would tend to confirm commercial experience that fan blown systems require superior insulation or greater wall thickness.

3. Determine the temperature drop through the 0.030-in. steel facings. It is derived by the formula:

$$T_f = \frac{Q}{A} \times \frac{X_f}{k_f}$$

T_f = Temperature drop through facing
$\frac{Q}{A}$ = Heat gain (7.4 Btu/hr£sq ft in this case)
X_f = Facing, thickness
k_f = Thermal conductivity of facing

T_f was found to be but 0.0007 F and is considered negligible.

4. Determine the thickness of insulation. First, the temperature difference through the insulation (ΔT_i) is the same as the difference between surface temperatures, since temperature drop through the metal surfaces is negligible. The thickness of the insulation (X_i) then is derived from the formula:

$$X_i = \frac{k_i\,\Delta T_i}{Q/A}$$

k_i is thermal conductivity of insulation

For home freezer walls containing insulation with a k = 0.208 at 42.5 F mean:

At 50 fpm air velocity

$$\text{Insulation thickness} = \frac{0.202 \times 83.3}{7.4} = 2.34 \text{ in.}$$

Plus facing thickness = 2 × (0.030) = 0.06 in.

Total wall thickness 2.40 in.

At 500 fpm air velocity

Table I—Confirmation of Air Film Coefficients (Btu/hr/sq ft/F)

Simulated Freezer Panel

Hot Side	Test 1	Test 2	Test 3
Air Velocity	50 fpm	50 fpm	50 fpm
Measured Air Film Coefficient	1.25	1.44	1.41
Calculated Air Film Coefficient*	1.56	1.51	1.51

Cold Side			
Air Velocity	100 fpm	100 fpm	250 fpm
Measured Air Film Coefficient	1.97	2.11	4.96
Calculated Air Film Coefficient*	1.98	1.97	2.54

Simulated Refrigerator Wall Panel

Hot Side	Test 4	Test 5
Air Velocity	50 fpm	50 fpm
Measured Air Film Coefficient	1.45	1.54
Calculated Air Film Coefficient*	1.53	1.50

Cold Side		
Air Velocity	100 fpm	200 fpm
Measured Air Film Coefficient	2.19	5.34
Calculated Air Film Coefficient*	2.15	2.71

* These calculated coefficients were computed using Heilman's equations for forced convection. These values are higher than those originally used in Phase A for forced convection.

[1] ASHRAE GUIDE, 1960 Edition, Formulas 2 and 3, p. 50. These equations were developed originally by R. H. Heilman and published in ASME Transactions (1929). C = 1.39 for vertical plates. D = height (in.) is 24 in. or more. Case 18 in Perry (Note 2) also gives 0.37 Btu. A value of 0.4 was used in calculations. Equation 3, p. 50 of 1960 ASHRAE GUIDE shows convection gain is close for both refrigerators and freezers.
[2] ENGINEERING MANUAL, R. H. Perry, McGraw-Hill (1959).
[3] ASHRAE GUIDE, 1960 Edition, Formula 5, p. 50. Table 4, page 54 of 1960 ASHRAE GUIDE may be used to determine values in this formula. A value of 0.9 was used for ε (effective emissivity). See Table 3, p. 54, 1960 ASHRAE GUIDE.
[4] ASHRAE GUIDE, 1960 Edition, Fig. 4, p. 106. The curve for glass and white paint on pine was selected and determined to be 0.245 Btu/hr/sq ft/F/mph air velocity.

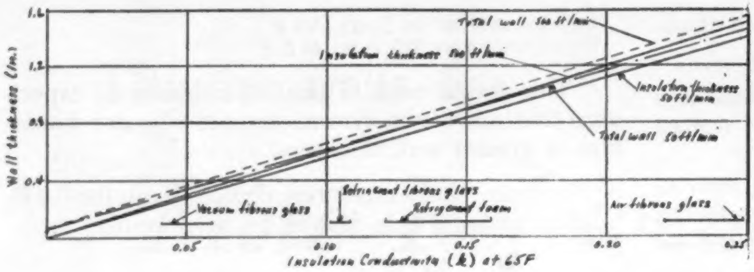


Fig. 1 Computed minimum wall thickness necessary to prevent condensation on a simulated refrigerator panel. (Assumed operating conditions – outside: 90 F, 85 per cent R.H. still air; inside: 38 F (a) 50 fpm air velocity, (b) 500 fpm air velocity

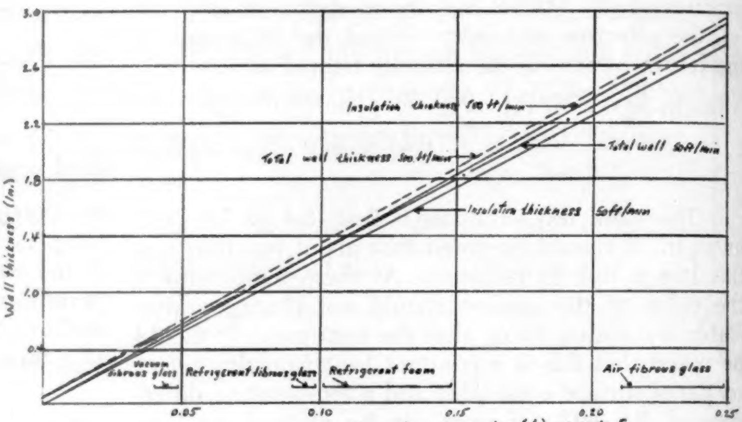


Fig. 2 Computed minimum wall thickness necessary to prevent condensation on simulated home freezer panel. (Assumed operating conditions – outside: 90 F, 85 per cent R.H. still air; inside –5 F (a) 50 fpm air velocity, (b) 500 fpm air velocity)

$$\text{Insulation thickness} = \frac{0.208 \times 86.9}{7.4} = 2.44 \text{ in.}$$

$$\text{Plus facing thickness} = 2 \times (0.030) = 0.06 \text{ in.}$$

$$\text{Total wall thickness} \quad 2.50 \text{ in.}$$

For refrigerator walls containing insulation with a k = 0.214 at 65 F mean:

At 500-fpm air velocity

$$\text{Insulation thickness} = \frac{0.214 \times 41.7}{7.4} = 1.20 \text{ in.}$$

$$\text{Facing thickness} = 2 \times (0.030) = 0.06 \text{ in.}$$

$$\text{Total wall thickness} \quad 1.26 \text{ in.}$$

At 500-fpm air velocity

$$\text{Insulation thickness} = \frac{0.214 \times 44.2}{7.4} = 1.20 \text{ in.}$$

$$\text{Facing thickness} = 2 \times (0.030) = 0.06 \text{ in.}$$

$$\text{Total wall thickness} \quad 1.34 \text{ in.}$$

Using the preceding conditions and formulas, minimum wall thicknesses were computed for different insulation systems and various facings.

Experimental confirmation of air film coefficients assumed in Phase A calculations: In the original calculations, heat gain was calculated to be 7.4 Btu/hr/sq ft through both interior and exterior surfaces assuming 0.4 Btu/hr/sq ft/F for thermal conductance due to natural convections. The values shown in Fig. 4, p. 106 of the 1960 ASHRAE GUIDE were assumed for forced convection heat gain. Finally, an emissivity of 0.9 was assumed to calculate radiation losses.

To confirm the computations on air film coefficients, two panels (49¼ x 73½ in.) were constructed and tested in a guarded hot box. The panel simulating a freezer wall was 2.28 in. thick. The panel simulating a refrigerator wall was 1.21 in. thick. Values measured in the guarded hot box were as shown on Table I.

Correlation, between measured and calculated air film coefficients, appears good in velocities around 50 to 100 fpm. However, limited measurements at 250-fpm air flow indicate that the effect of higher velocity may be more severe than previously believed.

Experimental confirmation of the calculated minimum wall thickness for fibrous glass insulation faced with painted steel: The simulated home freezer and refrigerator panels were placed in appropriate conditions of temperature and humidity by locating a panel in a window between a hot room and a cold room. In the case of the freezer panel, the cold air temperature was maintained at –5 F. In the case of the refrigerator panel, the cold air temperature was maintained at 38 F. In both cases, the hot room temperature was maintained at 90 F and the humidity was increased until condensation appeared.

Surface temperatures were measured by calibrated thermocouples, soldered directly to the surface of the panel. The surface temperatures recorded on the hot sides were checked with those temperatures determined from the psychrometric chart as condensation occurred.

Results appear to confirm the mathematical predictions of the first phase and are summarized below:

a. Simulated home freezer panel. Original calculations for the freezer panel predicted that 2.40 in. was the minimum wall thickness to maintain a hot side

surface temperature of 85.0 F and thus prevent condensation.

The freezer panel was 2.28 in. when tested in the guarded hot box, but when installed in the window, it expanded slightly to 2.36 in. as a result of handling.

Surface temperatures and condensation in the center of the panel were assumed to be the most accurate since the heat loss through the frame would induce lower hot surface temperatures. This assumption was confirmed by the tests, since condensation always occurred first at the edges.

The hot side surface temperatures at the panel center were mainly 85.0 F (before condensation occurred). In the first test, however, sweat first occurred in the center of the panel at 90 F, 89 per cent R.H. ambient. This was better performance than anticipated. It was felt that the system might not have had time to stabilize as humidity was increased during operation.

Thus, the test was repeated and condensation first occurred in the center of the panel at 90 F, 87.5 per cent R.H. The dew point (psychrometric chart) for these conditions is 85.7 F. The temperature recorded by thermocouples was 85.0 F.

From the psychrometric charts the conditions required for condensation on an 85.0 F surface are 90 F, 86 per cent R.H. not 90 F, 87.5 per cent R.H. recorded. A discrepancy of ± 0.75 per cent in measurement of relative humidity would account for the deviation between thermocouple temperatures and those computed by dew point. If the thermocouple readings are accepted, the mathematical predictions appear close. A 2.36 in. wall achieved theoretical performance of 2.40 in. wall.

b. Simulated refrigerator panel. Original calculations for the refrigerator panel predicted that 1.26 in. was the minimum wall thickness to maintain a hot side surface temperature of 85.0 F (and thus prevent condensation). Readings of the center thermocouples on the test panel averaged 84.9 F just prior to condensation. Light fog first appeared at 90 F, 85 per cent R.H. The dew point for such a condition is established as 84.8 F.

The difference between surface temperature measured by thermocouple and computed by dew point is but 0.1 F. If the thermocouple readings are judged as correct, the 1.22-in. wall gave the same results as a predicted one of 1.23 in.

Technical considerations upon which rigid foam is based and formed

P. A. SANGUINETTI

Rigid urethane foam has aroused interest in the refrigeration industry because of its mechanical strength, its thermal properties and the fact that it can be foamed in place.

Rigid foams require a resin with more branching, higher hydroxyl number and lower molecular weight than used for flexible foams. (See Table I.) Isocyanate, resin, catalyst and foam stabilizers are used to promote reactions at the proper rate and to create the proper conditions for the polymer to form, be blown and held until cure is effected.

PROCESSES USED TO PRODUCE URETHANE FOAMS

Three processes are used in the production of foams: the one-shot, the prepolymer and the quasi prepolymer. In the one-shot process all of the foaming components are mixed instantaneously. In the prepolymer process the isocyanate and the resin are prereacted to a specific point and the resulting prepolymer is then mixed with the foam components for foaming. The quasi prepolymer process falls between the one-shot process and the prepolymer process in that a prepolymer is prepared but additional amounts of both resin and isocyanate may be added for foaming.

P. A. Sanguinetti is Group Leader, Foam Technical Service, Mobay Chemical Co. This paper was presented as Theoretical Aspects of Foam Insulation at the Domestic Refrigerator Engineering Symposium at the ASHRAE Semiannual Meeting in Chicago, February 13-16, 1961.

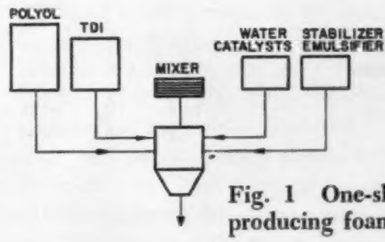


Fig. 1 One-shot process of producing foams

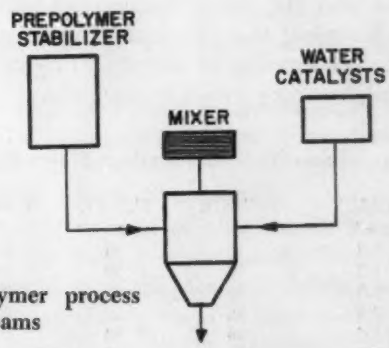


Fig. 2 Prepolymer process of producing foams

Table I—Resins for Urethanes

Type of Resin	Approx. OH No.	Type of Foam Produced
Ethylene Glycol + Adipic Acid	35-65	Flexible Polyester
Ethylene or Propylene Oxide + Diol or Triol	50-60	Flexible Polyether
Triol + Adipic Acid	250-350	Rigid Polyester
Propylene Oxide + Polyol or Diamine	350-700	Rigid Polyether

The frothing process may be used as a modification of any of the cited systems. This modification involves dissolving gas under pressure in the resin and allowing the gas to evolve at a lower pressure. This gas evolution produces a relatively stable froth while foaming and should facilitate molding thin sections of foam.

The three basic foaming techniques are shown schematically in Figs. 1, 2 and 3.

PHYSICAL PROPERTIES OF RIGID URETHANE FOAMS

The most obvious physical property of urethane foams which attracted the refrigeration industry is its low K factor. On a weight-K factor basis, it was recognized immediately as a superior insulating material. In Table II, the K factor of various insulating materials is compared with urethane.

Table II—Thermal Conductivity of Some Building and Insulating Materials

Material	DEN., p.c.f.	F (deg)	K
Asbestos	29.3	32	1.08
Alum. Foil, 7 Air Spaces/2.5 in.	0.2	100	0.300
Cork Board	10.0	86	0.300
Felt, Wool	20.6	86	0.48
Fiber Insulating Board	14.8	70	0.336
Glass Fiber	0.5	75	0.29
Mineral Wool	9.4	86	0.270
	19.7	86	0.288
Polystyrene Rigid Foam	1.8	40	0.25
Urethane, CO_2 Blown	2.3	75	0.24
Urethane, $C\,Cl_3F$ Blown			
(Cut Samples, Initial)	2.1	75	0.110
(Cut Samples, Fully Aged)	2.1	75	0.157
Slag Wool	12.0	86	0.262
Wallboard, Insulating type	14.8	70	0.336
Wool, Animal	6.9	86	0.252

K = Btu/hr/sq ft/F/in.

In discussing the properties of urethane foams, an effort should be made to specify the foam type, since the nature of the system, the form of the sample and the foam density can play a large part in influencing the physical properties. Table III gives the relationship of density to foam strength, K factor and moisture vapor transmission.

Table III—Fluorocarbon Blown Polyether Foams

DEN. p.c.f.	TEN. STR psi	YLD. PT. psi	K FACTOR **	MVT,* perm-in.
1.0	35	34	0.110	10-20
1.5	40	38	0.105	5-10
2.0	50	40	0.105	4-7
2.5	65	52	0.107	3-4
3.0	80	58	0.112	2.2-4
4.0	125	80	0.120	1.6-2.7
5.0	175	110	0.125	—
6.0	210	120	0.150	—
7.0	300	180	—	—
8.0	—	—	—	—

* One perm-in. = 1 grain of vapor/sq ft/hr/in. Hg pressure differential
** Btu/hr/sq ft/F/in.

Another property which also is normally a function of density is the foam heat distortion point. There has been little difficulty in obtaining 2.0 pcf foams which will withstand temperatures from –30 C to 110-120 C without shrinking or softening. Foams are available which retain 45-65 per cent of their initial

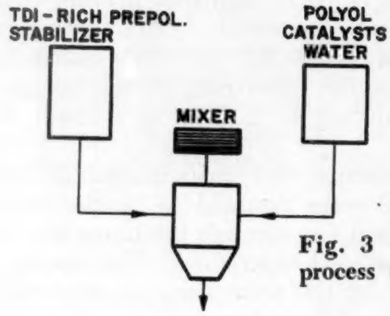


Fig. 3 Quasi prepolymer process of producing foams

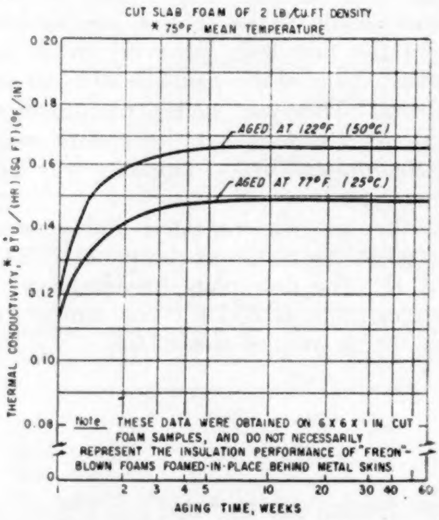
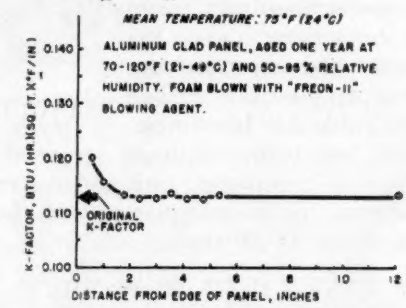


Fig. 4 Effect of temperature and aging on thermal conductivity of rigid polyether foam blown with Refrigerant 11. Aged at 25 and 50 C for 60 weeks

Fig. 5 Thermal conductivity of aged rigid foam



strength at 315 C but here density and economy are sacrificed for properties.

A property which is always important in new materials is their ability to age well. It is realized that laboratory or accelerated tests frequently are not easily extrapolated to predict the results of actual field tests; however, with more stringent conditions, a prediction can be made as to the results.

Fig. 4 relates the K factor retention when aged at 25 and 50 C for 60 weeks. These data were obtained on cut blocks and do not necessarily represent insulation performance of material foamed in place behind metal skins.

Loss in K factor caused by moisture penetration

is expected to be less when the sample is surrounded with metal where an additional vapor barrier is formed. Data obtained from an aluminum-clad rigid foam sandwich panel showed that after one year exposure, this sample more closely approached the results which could be expected in field testing. There was little or no K factor loss after the year. The test panel was 24 x 24 x 2 in. with 20-gauge aluminum sheet covering each 24 x 24-in. face. The foam was machine mixed and was poured vertically for these tests. (See Fig. 5.)

SUMMARY

An attempt has been made to summarize some materials and processes used in producing rigid urethane foams, their mechanical strengths and thermal properties, as well as some aging characteristics. It is established that urethane foam is a superior insulating material with unusual thermal properties. As is characteristic of most new engineering materials, some problems exist.

Some of the problems which currently are being investigated include the attack of the fluorocarbon on plastics sheeting and improved methods for preparing a self extinguishing foam. The former problem may be circumvented by substituting the type of plastics in contact with the fluorocarbon. The latter problem is being approached in two directions: the addition of new retardents to the foam as well as employing polyethers which act as retardents.

The ultimate confidence in rigid urethane foam as an insulating material is demonstrated by the use of this material. In 1960 it is estimated that approximately 5 million lb of rigid urethane foam was used in domestic refrigeration. It is predicted that approximately 50 million lb will be used in 1965.

ACKNOWLEDGMENT

Material for this presentation was obtained from the following sources and is gratefully acknowledged: E. I. duPont de Nemours, Inc., Pittsburgh Plate Glass and Mobay Chemical Company.

Bagged insulation, Refrigerant 12 permanently sealed in a laminated plastics envelope, is quite a different concept

ROBERT A. BILEK

It has long been known that the thermal efficiency of a fibrous type insulation could be improved substantially if it were placed in a vacuum or an atmosphere of a gas other than air.* Some years ago our organization sought to explore the feasibility of the use of this type of insulation in domestic refrigerators and freezers.

CHARACTERISTICS OF INSULATION CONSTITUENTS

Initial objectives included:

1. Selection of a high molecular weight gas of low thermal conductivity that was non-toxic, non-flammable and non-reactive with the other insulation constituents and the various appliance components.
2. Specification of the fibrous insulation.
3. Determination of an enclosing membrane of suitable permeability to water, air and the enclosed gas; a membrane which would have to maintain its strength and impermeability for a period of fifteen to twenty years, be handled and fabricated easily yet be relatively low in cost.

From the start, it was accepted generally that Refrigerant 12 would probably be selected for the gas phase of the insulation. It met all of the necessary requirements and its availability and cost were unquestionably favorable to a manufacturer already making use of the gas in the refrigerating system of the appliance.

Consideration was given to other gases, two of which were methyl chloride and carbon dioxide, because of their permeability behavior. Both were considered as diluents for the refrigerant and since both also had a higher rate of permeation through the test membranes, it was thought that they would tend to counterbalance the permeation of air into the bag, thus reducing design complications due to bag inflation. The idea was discarded, however, in favor of doing three things.

The bag would be charged with 100 per cent refrigerant vapor but at a pressure somewhat less than atmospheric.

An expansion chamber was to be made an integral part of the bag.

Advantage would be taken of clearances in the assembly of the appliance, so that, if necessary, the bag would have space in which to expand without affecting other components.

The requirements needed of the fibrous insulation to be used were that in combination with the enclosed gas it would give the desired thermal conductivity, be reasonable in cost and have sufficient rigidity to withstand any distortion that might occur during the charging process.

The first two objectives were relatively simple to resolve, in comparison to determining the enclosing membrane. A search through available literature was of little value except to give direction. It was necessary to undertake an intense program of research and development in order to determine the desired membrane.

Of the various materials studied, the one film that exhibited the most desirable results was polyvinylidene chloride, commonly known as Saran. While the material is characterized by high impermeability to water vapor and gases, good mechanical strength

* This was the subject of a paper presented at the 43rd Semiannual Meeting of ASRE in Boston, November 26-28, 1956, by Foster C. Wilson and published subsequently in the April 1957 issue of REFRIGERATING ENGINEERING.

Robert A. Bilek is Associate Design and Development Engineer, Hotpoint Company. This paper was presented as Bagged Insulation at the Domestic Refrigerator Engineering Symposium at the ASHRAE Semiannual Meeting in Chicago, February 13-16, 1961.

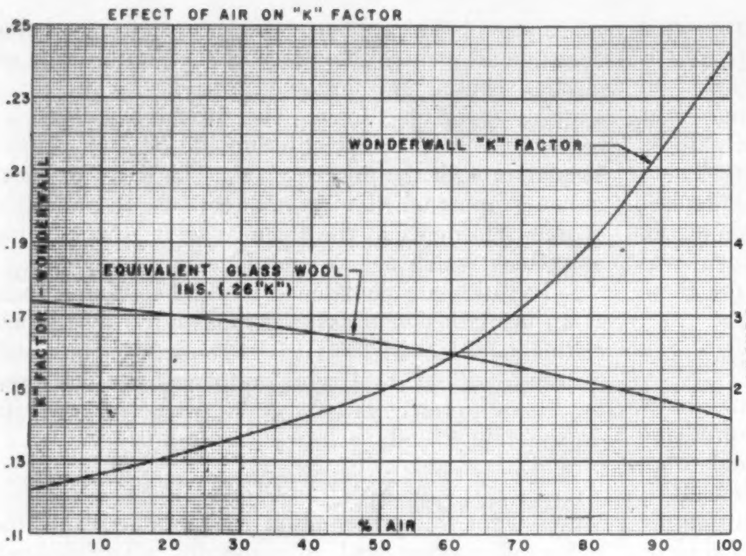


Fig. 1 Thermal conductivity of bagged insulation as a function of air dilution

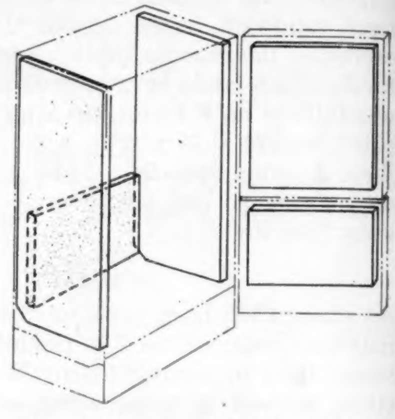


Fig. 2 Location of bagged insulation

and good high frequency sealing properties, it was found that it lacked adequate uniformity in thickness and composition for the proposed application. This incompleteness was overcome by laminating two layers with an adhesive so that the chance of imperfection was negligible. Furthermore, we discovered that the addition of polyester film and 40-lb kraft paper would provide the necessary abrasion resistance and ruggedness to withstand handling during fabrication and assembly.

We also discovered that, through the use of the paper, superior sealing was accomplished as compared to that made using non-paper laminates. It was thought that the paper, with its inherent resiliency, would compensate for variations in the polyvinylidene chloride, resulting in a more uniform pressure being applied along the entire weld seam; or that during the liquefication the film fibers from the paper would be intermixed, resulting in the stronger seam.

Use of the adhesives improved the impermeability of the laminate, as could be expected. While the impermeability is not a function of the adhesive thickness, it blocks permeation through or about irregularities and imperfections in the film and also prevents gases from diffusing laterally between two sheets, seeking weak spots in each.

The total thickness of the final laminate was 0.005 (min) – 0.007 (max) in. The outer layer is a half mil thickness of polyester film, the two innermost layers one mil polyvinylidene chloride, and the remaining thickness the paper. Identical layers of the same adhesive are applied between each layer.

Accelerated tests revealed the polyester film to be unaffected by aging and that the polyvinylidene chloride, while showing a loss of weight due to loss of plasticizer, increased in impermeability by approximately 10 per cent.

As shown in Fig. 1, the thermal conductivity will vary from 0.122 to 0.243 (Btu/in./hr/sq ft/F) depending on the refrigerant-air mixture in the bag.

Using a final limit of air dilution of 25 per cent over the expected fifteen-year life of the bag, the maximum allowable air dilution rate per year would be 1.67 per cent. Analysis of actual production samples returned from a controlled field test revealed an average of 1 per cent air dilution in the first year. This rate is expected to drop since the transmission rate is not only reduced by aging of the films, but also because it is a function of the partial pressure difference of the diluting air.

FABRICATION OF INSULATION

The laminated membrane described above is fabricated by an outside supplier and is received in mated sheets. The edges of the sheets are aligned within a tolerance of ± 1/32 in. and are pressed together on the polyvinylidene chloride side by the supplier to retain static coherence to keep their specified alignment until they are permanently secured by welding.

The first in line operation is that in which the two laminated sheets are sealed at three edges to form an envelope. The operator carefully locates the mated sheets on the bed of an indexing carriage, and performs the first seal. As the carriage indexes, the lengthwise edges are automatically sealed in parallel steps to form a continuous sleeve. The sleeve is then moved to another sealing machine where a cross seal is made, thus completing the envelope. Coincident with this seal the necessary trimming and piercing at the opposite end of the bag of holes needed in subsequent operations are done.

A visual inspection is then made over a laminated panel and all defects marked and identified.

The second in-line operation is the insertion of the glass wool insulation. This is done on a flat table which contains a holding fixture to keep the bag open and a loading sled set on recessed rollers onto which the glass wool is placed. The insulation is then slid through the holding fixture into the bag,

Table I

	Transmission Rates (cc/100 Sq In/24 Hr/Atm)
Oxygen	0.30 (Max-75 F)
Nitrogen	0.06 (Max-75 F)
Refrigerant 12	Nil
Moisture Vapor	0.10 (Max-90 per cent R.H. 100 F)

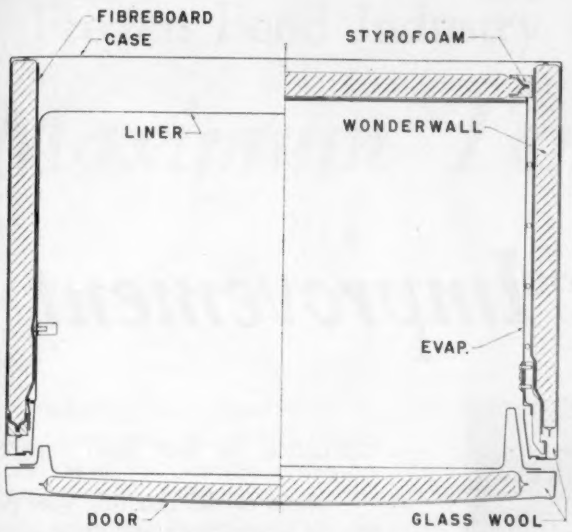


Fig. 3 Cross sectional views showing the application of bagged insulation

the subassembly clamped firmly and the sled withdrawn.

The envelope containing the glass wool is placed in a heated chamber (120 F $\pm$ 5 F) with the open end placed over the sealing bars.

Locating the hole pierced in the prior operation places the bag over a spring loaded device which brings the two sheets together in preparation for the final seal. A charging solenoid is swung into position and the charging nozzle inserted into the bag. The automatic operation that follows first closes the doors and evacuates the chamber to 5 mm Hg, or less, then charges the chamber with Refrigerant 12 vapor to 700 mm Hg. When the correct pressure is reached, the charging solenoid is energized automatically and the nozzle extracted from the bag, the final seal is made, and the chamber doors opened.

The leak detection mechanism is a sealed chamber of two piece construction, so that when the chamber is closed its lining completely envelops the insulation test package. The lining is flexible and is configurated so that leaking gas will not be confined. After placement of the test bag, the chamber is sealed from the atmosphere and the space between the bag and the lining evacuated to 1,000 $\pm$ 50 micron. The space then is sampled by a leak detector. The sensitivity of the mechanism is checked periodically for leaks to the atmosphere, for sensitivity and against false leak indications.

Because the corners of the bag were found to be the most vulnerable to handling, they are reinforced with a modified plastics. This operation is accomplished by dipping the corners into the thermoplastics material, which is maintained at approximately 235 F, and is done rather quickly to avoid overheating of the laminate.

USE AND INSTALLATION

Use of bagged insulation was based on optimum conditions of performance (thermal conductivity), marketing requirements for the appliance, possible manufacturing problems and cost. One of the advantages of this type of thin-wall insulation is that it does not require final assembly techniques different from those used to produce all other models, although some special education of the operators was necessary because of its vulnerability to puncture.

Standardization of the major refrigerator components was attained since the outer case and door panel assemblies were specified for models other than those in which our insulation was to be used. This kept initial tool costs to a minimum. By specifying bagged insulation in the areas shown in Fig. 2 – the entire two sides, behind the evaporator, plus as the main portion of the door insulation – the volume of what would normally be a refrigerator of 14-cu ft capacity was now transformed into one of 18 cu ft.

Cross sectional views through the fresh food and freezer compartments more closely reveal the role of bagged insulation in the completed refrigerator. The side pieces, 1⅝ in. thick, have served to reduce the actual wall thickness from 3-1/8 in. to 1-13/16 in.

Full advantage of the bag thickness was not taken, so that assembly difficulties could be avoided. Pilot runs indicated almost immediately that the addition of a 0.040-in. piece of fiberboard would be necessary to protect the bags during the assembly of the evaporator and fresh food liner.

To fill in areas not included by the bag, the application of the expanded polystyrene was used as an additive to the edges of the bag where necessary, and a superfine type of glass wool was used as a filler elsewhere. In the case of the door insulation, as well as behind the evaporator, the superfine filler is softened to a maximum yet retains its resiliency, thus acting to take up assembly tolerances as well as providing a flexible space into which the bag can expand.

Wherever possible the use of screws and mounting components in the insulation space was avoided, but where necessary the mounts were designed for smooth edges and the screws arranged to be assembled in a direction away from the space or kept totally enclosed within the fastened part.

There is Room for Great Improvement

Technical activities carried on in committee are a vital part of the operation of the Society. They provide the means by which members having common interests may be brought together for activities leading to the development and dissemination of information and ideas. Such activities are valuable to the Society as a means of dealing with many technical matters which arise in the course of achieving its objectives but they are also an important means by which members may find personal satisfaction through individual participation. Both of the former societies had developed a pattern of technical committee activity and it was only natural that this should have been continued in a suitably amended form in the merged Society.

The Society now has some 56 Technical Committees assigned to cover a corresponding number of particular areas of technical interest, with a total membership of about 500. This represents a tremendous potential for a worthwhile contribution to the work of the Society and to the satisfaction of its members. Unfortunately, it is necessary to report that we are still far from the full realization of this potential.

There is room for great improvement in the organization and functioning. Some committees have much work to do and are quite active; others are less vigorous. Some are still confused as to their function. Some are large and unwieldly while others have not yet recruited enough people for their operation. Some committees have been able to hold meetings while others have attempted to carry on mainly by correspondence. There have been many reasons for these difficulties. It is important that these be understood in order to be able to assess what has already been accomplished and to work toward improvement.

It was the objective in planning the merger that the best features of both of the prior societies be retained. The technical committee pattern of ASRE was combined with a much modified form of the research committee pattern of ASHAE. Both of these were brought under the Research and Technical Committee, but were organized in two distinct groups providing for separate research and technical operations.

N. B. HUTCHEON

It was inevitable that part of the new pattern would be unfamiliar to all members. But, the steps which had to be taken to establish new committees quickly once the merger was brought about inevitably led to some further misunderstanding and confusion. At the beginning of the first year of operation on the new basis, all former Technical Committees and Technical Advisory Committees were reappointed, but with the Technical Advisory Committees being renamed Research Advisory Committees as a temporary expedient.

This provided a breathing spell of six months during which the Research and Technical Committee gave consideration to the establishment of the six permanent Research Advisory Committees with appropriate Research Panels. The members of the reappointed Technical Advisory Committees then were reassigned at mid-year to existing or to new Technical Committees so that the services of everyone who had been reappointed to any Committee for that year were retained.

Much of the resulting new pattern of committees and their memberships did not therefore evolve slowly but was created relatively rapidly and in some cases quite arbitrarily. The separation of research and technical functions, the more involved lines of communication between Committees and the division of secretariat support for Committee work as between the head offices in New York and the Laboratory at Cleveland presented an unfamiliar pattern.

All of this coincided with changes and new problems in other areas of Society affairs. The Research and Technical Committee itself has for the past eighteen months been greatly preoccupied with important matters of research policy, and has had little time to consider technical activities. It is now faced with the need for a further reorganization of Committees with the closing of the Research Laboratory, as has already been outlined by the Chairman in the Research Page of the April issue of the JOURNAL.

There has not yet been a period of normal operation under the present arrangement of Technical Committees. Despite this, a great deal of good work has been done, and many chairmen and their committee members have carried on with the greatest of good will and understanding. Assistance has been rendered with Annual and Semiannual Meeting programs. GUIDE AND DATA BOOK chapters have been reviewed or revised. Standards have been reviewed, and assistance has been given with a variety of requests for technical information. Some committees have engaged in data gathering and study programs designed to produce needed technical information in usable form. During the past year, all technical committees have been asked to assume some responsibility for the promotion of suitable technical papers

(*Continued on page* 116)

N. B. Hutcheon, guest sponsor of this Research Page, is Vice Chairman of the ASHRAE Research and Technical Committee.

Frozen Food Industry sets goal of

Maximum Temperature of 0F

for handling and distribution

Our industry has experienced a tremendous rate of growth since World War II. Today, some 8,250,000,000 lb of frozen foods are produced annually – almost 50 lb for every man, woman and child. Only 25 years ago, in 1935, less than 400,000,000 lb of frozen foods were processed in the United States and these were available only in a small area, mainly the northeast.

The shortage of tinplate and resultant rationing of canned goods during World War II provided the first major stimulus for frozen food expansion. However, even at the end of the war, in 1945, frozen food production was approximately 800,000,000 lb, but 10% of the industry's annual output today.

In the decade of the 1950s alone, production of frozen foods, spurred on by increasing consumer acceptance, quadrupled from 2,171,000,000 lb in 1950 to 8,032,000,000 lb in 1959. Our products accounted for somewhat under 2% of all retail food sales in 1950, while nine years later, in 1959, they produced more than 4.8%. In terms of dollars, retail sales alone during the same period soared from slightly less than $500,000,000 annually to $1,950,000,000 in 1959.

We predict that when the 1960 figures finally are compiled, retail sales of frozen foods in the United States may reach the $2,250,000,000 mark.

Although every category of frozen foods has contributed to this rapid growth, the expansion of a number of these is without precedent in the food industry. Output of precooked foods, for example, was 1900% greater in 1960 than it had been ten years earlier. Concentrate sales rose more than 600%. Sales of frozen poultry were 750% greater in 1960 than they had been at the beginning of the decade.

EDWARD SHERBY

Sales and production figures, however, tell but part of the frozen food growth story. To appreciate truly what our industry has accomplished, it should be kept in mind that we had to do more than sell the American consumer on a totally new concept in food preservation. More difficult, we had to build a distribution system that would keep our products at temperatures well below the freezing point all the way from the processing plant to the table.

REFRIGERATED STORAGE SPACE

When frozen foods first made their appearance, refrigerated storage space that would hold 0 F temperature was, to all intents, practically non-existent. There were no retail cabinets that would hold the necessary low temperatures. There were no railroad cars or trucks capable of hauling our industry's products at temperatures even approximating 0 F. Household refrigerators with separate frozen food holding compartments, not to speak of the home freezer, had yet to be designed.

How different a picture the industry presents today. In 1959 there were some 350,000,000 cu ft of public refrigerated storage space capable of holding frozen foods at below-zero temperatures, as well as an additional 110,000,000 cu ft available in packer chains and distributor warehouses. Ten years earlier but 168,000,000 cu ft of frozen foods storage space of all types was available.

In 1949, most frozen foods shipped by rail were refrigerated with ice and salt mixtures. There were fewer than a dozen mechanically refrigerated railcars in existence. Today there are nearly 4,000 reefers capable of holding product at 0 F operating on the nation's railroads. There are some 35,000 trucks hauling frozen foods today. Half of these can maintain circulating zero temperatures and a large proportion of the others can come close.

Ten years ago, the most modern supermarkets were installing 30 to 40 ft of cabinets. Data submitted by Super Market Institute members show that cabinet footage installed in new stores doubled in the 1955-59 period, with the average new market allocating 100 ft for frozen food displays.

TEMPERATURE CONTROL

Constantly rising frozen food production and sales curves serve as evidence that, by and large, the industry has succeeded in bringing high quality products to market.

One further pertinent consideration is that this growth was achieved without tremendous expenditures in advertising and pro-

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Edward Sherby is Editor and Publisher of Frosted Food Field. This paper, here somewhat condensed, was presented at the Frozen Food Handling Symposium at the ASHRAE Semiannual Meeting in Chicago, February 13-16, 1961. Another paper from this Symposium, Integrated Time-Temperature Experience as it Relates to Frozen Food Quality, by D. G. Guadagni, appeared in the April issue of the ASHRAE JOURNAL.

motions that characterize other industries. Here, then, is still another manifestation of growth founded on consumer acceptance that is based upon quality; in other words, in a food product which satisfies consumer demand.

Impressive as the record of our industry has been in setting up a low-temperature distribution system and winning consumer acceptance, it has now embarked on an effort to surpass its past performance. The entire industry is now united in an attempt to eliminate those obstacles that have prevented it from holding the temperature of its products at a maximum temperature of 0 F at every point of the chain of distribution. Through its determined efforts to reach this goal, a "quality conscience" has emerged to become the dominant factor in the frozen food industry today.

This does not imply that the concept of zero degree distribution is new to our industry. It has been called for by its most responsible segments and urged by its trade press for the better part of a decade.

Now, however, due to the dissemination of an increasing body of quantitative data confirming that 0 F does afford a significant margin of quality protection to frozen foods, as well as to a number of outside stimuli and to the availability of new and more efficient refrigeration equipment, zero degree distribution has made the transition from a concept that is discussed at meetings to a rule that will undoubtedly become universal in frozen food handling within the next several years.

This concern for temperature control of product started when the Western Utilization Research Laboratories released the first of its reports on the results of time-tolerance research studies that had been underway since 1948. These studies, heavily subsidized by the Refrigeration Research Foundation, showed for the first time the extent of quality loss when product is subjected to high or fluctuating temperatures.

Determined that the results of these studies should be made known to everyone handling frozen foods — from processor to supermarket stock clerk — the industry that year formed the All-Industry Task Force to serve as an educational body whose objectives were the maintenance of proper temperatures throughout the distribution cycle. This body was formed on the initiative of the National Association Of Frozen Food Packers, which served as a clearinghouse for all educational materials on frozen food handling, but agencies, organizations of government, rail and truck transportation, the warehousing industry, distributors, retail grocers and food chains as well as the Florida Citrus Commission and the National Fisheries Institute also were represented.

> . . . Continually rising sales of frozen food are evidence that the industry is making available high quality products . .
>
> . . . Distribution at 0 F will be the rule in frozen food handling within the next several years . . .
>
> . . . While 0 F distribution is desirable, temperature alone is not the only criterion in the maintenance of frozen food quality . . .
>
> . . . It is recognized that the 0 F goal cannot be met by all segments of the frozen food industry today . . .
>
> . . . Frozen Food All-Industry Coordinating Committee is formulating a voluntary code of practices to govern the handling of frozen foods at every point of distribution . . . Code to be enforced by the industry itself.

Until this past year, when it was superseded by broader industry organization with wider goals, the All-Industry Task Force met twice annually to review what each segment of the frozen food industry had done to improve handling in its area of distribution. It compiled a list of approximately 60 educational booklets and other materials that had been published by its member organizations and did an effective job of getting these materials into the hands of the industry.

At about the same time, the frozen food industry received still another stimulus to improve its handling techniques — this time from public health officials. Pointing to the potential health hazards that they saw in precooked foods especially, food and drug officials in a number of states began to urge legislation to define proper handling conditions and to authorize seizure of products that did not adhere to these.

In an attempt to obtain uniformity in such state legislation, the Association Of Food And Drug Officials of the U. S., AFDOUS, began work on its Model Code that would govern sanitation, proper temperature and quality of frozen foods. It recommended meanwhile that states withhold legislative action until its code would be completed, so that state laws would be uniform. The first draft of Section I of the AFDOUS Code, covering handling of frozen foods, was released just about a year and a half ago, and, in essence, it made a maximum temperature of 0 F mandatory during all phases of distribution. When it released the text of its Code, AFDOUS suggested to its members in the various states that they withhold legislation based on it for a year, but at the same time cautioned the frozen food industry to prepare to comply with such laws by that time.

Although the frozen food industry is in agreement with AFDOUS on the desirability of maintaining frozen food distribution temperatures at a high of 0 F, it has nonetheless opposed enforcement of the code. Maintaining that the Code should be a guide for the industry and not the basis for legislative action, the industry bases its objections on the following considerations:

(A) While temporary exposure of frozen foods to temperatures above 0 F may affect quality, it does not pose a health danger, and governmental agencies are not empowered to regulate a factor as intangible as quality.

(B) Temperatures at which frozen foods are distributed has been reduced over the years. This has been a result of many factors, but principally because of the emergence of the "quality conscience," because of self-interest designed to sell that half of the nation's families who are not regular users of industry products, and to improvement in capital equip-

ment. To expect the industry to discard costly capital equipment to meet the requirements of a rigid zero degrees code — a code, incidentally, that makes no provision for tolerances — does not appear reasonable.

There have been no cases of botulism due to frozen foods. This is not surprising, since our products are frozen at subzero temperatures and any microorganisms which survive this low temperature exposure have little or no public health significance. Even flavor-changing organisms, as a rule, are destroyed at temperatures of about 15 F, and, as a result, temperatures of 10 F should certainly be sufficient to protect frozen products against this type of flavor loss.

Also, we are apt too often to forget that while zero degree distribution is desirable as a means of giving frozen food quality that extra margin of protection, temperature alone is not the only criterion in the maintenance of frozen food quality. Quality does not deteriorate only from exposure to higher temperatures, but rather from length of time of exposure to a given temperature. Thus, quality losses even at temperatures considerably above zero are not necessarily as marked as is sometimes believed.

Time-temperature tolerance studies have shown, for example, that in vegetables storage for 365 days at 0 F is equal to 182 days at 5 F, 91 days at 10 F, 42 days at 15 F, 21 days at 20 F, 10 days at 25 F, or 5 days at 30 F.

GOAL TO BE ACHIEVED GRADUALLY

The fact that even considerable exposure to higher temperatures is not as destructive as is sometimes thought, does not detract from the original statement that the industry considers the zero degree goal one well worth aiming for. There can be little argument against the fact that this temperature does protect our products better than, for example, 10 F. But I must emphasize that this is a goal we want to reach as rapidly as possible. It could not, however, be met by all segments of frozen food distribution today.

At the present time, the processing and the warehousing segments of our industry can readily hold products at zero degrees at all times. Almost without exception, products in the processing plant are rapidly frozen at temperatures as low as –30 to –40 F and are moved immediately into the processor's warehouse, where they are stored at subzero temperatures. Similarly, it can safely be said that all warehousing, whether public facilities or belonging to packer, distributor or chain, have installed refrigeration equipment and insulation capable of holding temperatures of –5 F or lower. Palletization of frozen products in storage is almost universal, allowing proper circulation of frigid air around the food and helping to hold product temperature.

While the processing and warehousing segments of our industry have no trouble reaching their zero goal, the transportation picture is less clear. All of the 4,000 reefers hauling frozen foods on the nation's railroads are said to be capable of holding product at zero under all types of weather conditions. Part of the reason for this is that this type of equipment is still relatively new, the first mechanically refrigerated railcar having been ordered in 1948 and the bulk of the units in the past five years. The railroads have thus had the advantage of being able to incorporate the most recent advances in refrigeration equipment and insulation in their construction.

Of the 35,000 refrigerated trucks carrying frozen foods over our highways, approximately half can hold zero temperatures under all but the most adverse conditions. Most of the remainder can probably also maintain zero under the normal run of conditions, especially if they have been precooled before loading. However, even a well-insulated truck with a good refrigeration unit that is hauling a product half way across the country on a hot summer day — especially if it has to make several stops to deliver product enroute — is apt to arrive at its destination with temperatures as high as 10 F, even if it has been precooled to –20 F before loading.

This long-haul trucking picture is, however, changing rapidly. Truck-trailer manufacturers are producing models with superior insulation and producers of refrigerating units have designed and are now offering heavier-duty models to the industry. An increasing number of these newer model trucks will come into duty as present equipment becomes obsolescent. Since the trucking companies have a heavy capital investment in their current models, it will be four or five years before all long-haul trucks can hold zero temperatures under all conditions.

One of the most troublesome problems in temperature maintenance is faced by the frozen food distributor. The average distributor route delivery truck covers many miles per day and normally makes numerous stops, opening and closing the door at each stop. If the sun is hot, temperature naturally rises each time the door is opened. Many distributors are now utilizing devices such as plastics curtains in the rear of the truck, to provide insulation while the door is opened, and are training their personnel to keep the door open for the minimum possible time, but these have not proved to be the complete answers to the problem.

Retail outlets comprise another segment of the distribution pipeline that will require time for amortization of existing equipment before it can reach the desired goal. Recent models of display cabinets probably can hold temperatures of zero or less if care is taken in their placement in the store, if they are not loaded above the specified point, and if they are defrosted at frequent intervals — all requiring proper personnel training. Many cabinets, purchased even a few years ago, still cannot do this, no matter how carefully they are maintained. A comprehensive survey of 1366 retail frozen food cabinets three years ago found that only 45 per cent had temperatures of 0 F or below, while 32 per cent registered temperatures of over 5 F. More time will be required before ideal cabinet temperatures are realized universally.

Although almost all newer stores have sufficient backroom storage facilities, this is not gen-

erally the case in older outlets. It was found that in 558 stores, 76 per cent had backroom storage facilities. Of these, 50 per cent maintained temperatures of zero or less, while 25 per cent were higher than five degrees.

One of the most difficult problems that all segments of the industry face is that of personnel education. Frozen foods may easily be held at frigid temperatures in a warehouse, but if they are then left out on the loading dock, no amount of new equipment can prevent temperature rise. Similarly, delays in moving product from backroom freezers into the zero cabinet in a supermarket makes new equipment investments go down the drain.

Despite these difficulties, 0 F will undoubtedly be the rule in frozen food distribution in the not distant future. It can further be predicted that this goal will be reached through the desire of the industry itself to raise its product quality to new heights, rather than through the intervention of an outside agency.

INDUSTRY CODE

While the All-Industry Task Force has been effective in educating all segments of distribution on the necessity for rigorous control of temperatures, it is recognized that education alone is not enough. About six months ago our industry organized the Frozen Food All-Industry Coordinating Committee. Although it has taken over the educational function of the task force, the major objective of this new group is to formulate and put into effect a voluntary code of practices that will govern the handling of frozen foods at every point of distribution.

Nine organizations—accounting for every phase of frozen food production or distribution—are represented on this Coordinating Committee. They are the American Meat institute, the American Trucking Associations, the Institute of American Poultry Industries, the National Association of Food Chains, the National Association of Frozen Food Packers, the National Association of Refrigerated Warehouses, the National Association of Retail Grocers of the U. S., the National Fisheries Institute and the National Frozen Food Association.

Each organization has drawn up a code for handling frozen foods in its area of distribution. At the present time, these individual codes are being integrated into an all-industry handling code that will set standards for the handling of frozen foods from the time they come off the processing lines until they are purchased by the consumer.

Although the final draft of this industry code has not yet been released, its general aims and content have been stated. Its objective will be to maintain the temperatures of all frozen products at a maximum temperature of zero throughout distribution. At the same time, the code will be realistic. It will start with frozen food distribution as it is today and will honestly face the many problems that have yet to be overcome. It will set zero as the goal to be reached in the shortest possible time, but will recognize that this objective will not be reached by fiat.

This industry code is expected to provide for the reaching of the zero degree target in a series of gradual stages. It will probably allow a maximum temperature of 10 F for a specified period of time, subsequently lower this to 5 F, and eventually make zero mandatory. In this manner, frozen food distribution can proceed in an orderly manner while companies tighten up their handling procedures and are given an opportunity to amortize equipment now in use in which they have a heavy investment.

The code will be policed by the industry itself, with each segment of the distribution chain checking on the performance of its predecessor. Thus, warehouses will refuse to accept shipments with excessive temperatures, while truckers, distributors, and supermarkets will do the same.

FROZEN FOODS AND THE REFRIGERATION INDUSTRY

All along the way we have been dependent upon the indispensable aid that the refrigeration industry has provided and now we shall undoubtedly be asking for more in the future.

We want more powerful and efficient refrigeration units for plant and warehouse. We need units for trucks that can guarantee frigid temperatures on the hottest summer day. There is a need for vast improvement in the design of retail cases. We envision multi-tiered cabinets that will utilize presently wasted air space in supermarkets, perhaps with sliding doors or an air curtain to keep the warm air away from our products.

If frozen food consumption were just to remain at its present level, our industry will require in the immediate future some 17,500 long-haul trucks with mechanical refrigeration units, thousands of distributor route trucks that can maintain zero temperatures, compressors for the backroom storage areas being built by stores that still have none and more efficient refrigeration units for the tens of thousands of linear feet of retail cabinet space that will be installed to replace obsolescent models.

But consumption will not remain the same. As our quality improves and we sell more, it is not unreasonable to expect our present 8,000,000,000 lb annual production to rise to 12,000,000,000 by the end of the decade.

WHO'S WHO IN ASHRAE

Insofar as possible these listings will each appear twice a year

ASHRAE OFFICERS, DIRECTORS COMMITTEES, STAFF

See page 94, this issue

REGION AND CHAPTER OFFICERS

See page 80, March JOURNAL

RESEARCH AND TECHNICAL COMMITTEES

See page 67, September JOURNAL

STANDARDS PROJECTS

See page 84, May JOURNAL

INTER SOCIETY COMMITTEES

See page 84, November JOURNAL

ASHRAE-UEC Fund Passes $41,000 Mark

As of May 5, 1961, ASHRAE contributions to the United Engineering Center fund raising campaign totalled $41,130.66. We now have $208,869.34 to go.

SURE . . . we have made progress. BUT . . . let's look at the facts. During the last eight weeks, we have raised $5,042.37, which averages to slightly more than $630.00 a week. This is decidedly a poor showing. In August, the ASHRAE staff expects to move into the new Center, financed partly by contributions of the members of all 19 tenant societies.

The majority of these societies has either exceeded its quotas — many substantially higher than ours — or is quite close to achievement of its goals — ONLY ASHRAE lags far behind.

To date, 77 chapters have organized campaigns and appointed chairmen. Three chapters—Central Oklahoma, South Piedmont and Toledo—have fulfilled their quotas. However, there are still 10 chapters which have not yet indicated any participation in this campaign: NIAGARA PENINSULA, SOUTHERN ALBERTA, BALTIMORE, CENTRAL PENNSYLVANIA, HAMPTON-ROADS, WISCONSIN, CENTRAL MICHIGAN, ST. LOUIS, ALAMO and FORT WORTH.

Your contribution to the United Engineering Center is a GIFT to a worthy project . . . a monument to all the engineering profession. Our goal of $250,000 is based upon a contribution of $15.00 a member. This amount can be contributed over a three-year period. Don't buy that extra knick-knack. Fill out the pledge card at the bottom of this page and send in your first payment, TODAY.

ASHRAE will have a voice in operating this center. Let us be proud in the knowledge that we did our part in building it.

NAME ....

ADDRESS ....

IN CONSIDERATION OF THE GIFTS OF OTHERS INTENDS TO GIVE TO

UNITED ENGINEERING CENTER BUILDING FUND

..................................DOLLARS $........

BALANCE TO BE PAID QUARTERLY $........, SEMIANNUALLY $........

ANNUALLY $........, OR AS FOLLOWS ....

SIGNED..

MEMBER ASHRAE

CHECK MAY BE MADE PAYABLE TO UNITED ENGINEERING TRUSTEES, INC.
29 WEST 39TH STREET, NEW YORK 18, N. Y.
GIFTS ARE DEDUCTIBLE FOR INCOME TAX PURPOSES

What ASHRAE Regions and Chapters are doing

Joint meetings were held in April by various Chapters, in several cases in conjunction with a tour. Visited were the University of Missouri, a new office building, an atomic power plant and a brewery, among others.

ST. LOUIS & KANSAS CITY . . . Meeting jointly at Columbia, Mo., both Chapters toured the engineering facilities at the University of Missouri. Special emphasis was placed on the thermoelectric, cryogenic and nuclear reactor laboratories.

Effects of comfort cooling on farm animals were demonstrated at the Climatology Laboratory of the Agricultural College. Increased productivity of dairy herds resulting from controlled environment is cited as making installation of equipment of this nature economically advisable.

Following the tour, Dr. A. Emmons, Director of the Missouri Research Reactor, discussed the reactor and its relation to industry. In addition to detailing operating characteristics of the unit, he stressed the need for proper ventilation, filtration and temperature and humidity control in the work area. Practical applications of the reactor were covered.

who's doing what . . . Nominated for Kansas City Chapter offices are: W. Scurlock, President; E. Hopkins, 1st Vice President; E. Engelhardt, 2nd Vice President; P. Moreno, Secretary; R. Kilker, Treasurer; and J. Dukelow, A. Sneller, R. Perkins, H. Burkhart and G. Hart, Board of Governors.

LONG ISLAND . . . Zone control of hot water heating systems with primary and secondary pumping was discussed at a recent meeting by Walter Higham of Bell & Gossett.

Announced for a future date was an Air Conditioning Seminar, to be held in conjunction with the State College at Farmingdale.

who's doing what . . . Clyde Alston, Robert Beechenor and William Mahon were tellers for counting the ballots in election of officers. Elected were: S. Gayle, President; W. Kane, Vice President; K. Henry, Secretary; L. Bloom, Treasurer; B. Maxwell, Financial Secretary; and S. Walzer, Board of Governors.

CENTRAL OKLAHOMA . . . Guest speaker for the March 13 meeting was W. E. Barrett, Senior Applications Engineer, Fluid Drive, American Blower Corporation, who discussed "House Pump Fluid Drives".

who's doing what . . . Paul Sprehe, G. T. Donceel, J. Patton, W. Henke and Ray Thomasson have been elected to the Nominating Committee.

"Economics of Air Conditioned Schools" was the topic of April speaker Z. A. Marsh, Director of School Activities, Minneapolis-Honeywell Regulator Company.

who's doing what . . . Selected by the Nominating Committee for offices for the coming season are: W. H. Stewart, President; James McKinney, Vice President; Carl Jensen, Secretary; and Marion Cohenour, Treasurer.

CENTRAL PENNSYLVANIA . . . Blaine Book, Chief of the Boiler Div, Inspection Bureau, Department of Labor & Industry, spoke at the April 19 meeting. Covered in his discussion was the history of boiler inspection in Pennsylvania from Civil War days to the present. In 1916 the Pennsylvania regulations for boilers first were drafted, detailing construction, installation and operation and providing for examination and commissioning of inspectors. The Boiler Div was created in 1923.

Discussing pressure vessels, speaker Book dealt with maintenance, inspection, pressure vessel failure and prevention of accidents. Necessity for safety valves was cited.

FORT WORTH & DALLAS . . . Speaking at a joint meeting of these Chapters, held on April 19, Charles Rink of Industrial Acoustics Company presented a "Practical Explanation of Sound Control and Solutions".

who's doing what . . . Dallas Nominating Committee Chairman E. J. Stern proposed the following for office: President, R. A. Osterholm; 1st Vice President, F. L. McFadden; 2nd Vice President, A. A. Hooper; Secretary, Oslin Nation; Treasurer, W. P. Dickson; Board of Governors, R. Kilpatrick, J. Jordan and Marvin Brown, Sr.

WESTERN MICHIGAN . . . Regional Director L. K. Warrick was present at the April 10 meeting to discuss regional and Chapter matters. ASHRAE Second Vice President John H. Fox covered Society functions, standards, the JOURNAL, GUIDE AND DATA BOOK and regional organization.

who's doing what . . . Elected for the 1961-62 season are: G. L. Jepson, President; D. A. Rackliffe, 1st Vice President; W. Wessels, 2nd Vice President; L. H. Hinkel, Secretary; C. W. DeKorte, Treasurer; and S. R. Curtis, R. J. Waalkes and J. F. Belton, Board of Governors. R. J. Waalkes and D. J. Renwick are Regional Meeting Delegate and Alternate, respectively.

UTAH . . . Discussing "Noise Control", March speaker Lee Irvine used slides to illustrate sound waves and how they begin. He demonstrated how the frequency can change a sound and presented a scale showing the decibel rating of various sound sources. Acoustical insulation of air conditioning equipment was covered and suggestions were made.

Speaking at the April 24 meeting was architect

Dean Gustavson. Development of Salt Lake City was the topic under discussion.
who's doing what . . . Nominating Committee proposals are: C. E. Warren, President; J. N. Eichers, Vice President; R. Williams and J. Lee, Secretary-Treasurer; and T. Brown, LeRoy Peterson, R. Reese and G. Wilcox, Board of Governors.

NEW ORLEANS & BATON ROUGE . . . Operation of the Jackson Brewery was described to members attending the joint meeting of these Chapters, held March 22, by Assistant Chief Engineer Blaise D'Antoni, Jr. By use of a line diagram, he traced the brewing process from beginning to end, covering such items as treatment of city water for pH and phenol content.
who's doing what . . . P. Fischer was nominated from the floor for membership on the Board of Governors.

MONTREAL . . . Construction in Canada was discussed at the February 20 meeting by Russel W. Cornell, who then moderated a panel discussion. Members of the panel were Henri LaBelle, Reuben Brasloff, Thomas Urquhart, E. Twizell and T. K. Birss.

Covered by March speaker K. E. Robinson, in a discussion of "Comfort and Made Up Air for Industry", were effective temperature, air movement and radiation. Methods of heating and exhausting were shown, with slides illustrating different plant ventilation systems. Proven effective in areas tested was evaporative cooling. Refrigeration added to such a system, using 100% outside air, was cited as being less expensive than a recirculating system with less air movement. An air discharge at ten ft above floor level was cited as being satisfactory with velocities from 1600 fpm up.
who's doing what . . . Recommendations of the Nominating Committee are: H. B. Cooper, President; M. Malloy, 1st Vice President; C. R. Morrison, 2nd Vice President; D. C. Longman, Secretary; F. Mallozzi, Treasurer; and G. Forget, J. F. Bertram, T. K. Birss, H. J. Mattocks, J. C. Springer and W. Bingham, Board of Governors.

CENTRAL INDIANA . . . Hosts for the March 14 tour of the Continental Bakery were Manager L. Batty and Plant Engineer Frank Murray. Data about the bakery operation were presented and facilities were explained during the tour.

William Batchelor, Chief Engineer, Tuttle & Bailey Div, Allied Thermal Corporation, spoke on "Air Distribution Systems" at the April 11 meeting. Dealt with were noise evaluation, generation, attenuation and control.

BRITISH COLUMBIA . . . "Topic of the Month" for March, "Effect of Cold Storage on Frozen Food Quality", was presented by John Marsh. Problems discussed included need for uniform temperatures throughout to prevent spoilage of food in lower layers and dehydration caused by heat passage from top layers to bottom.

Purposes of ASHRAE were reviewed by guest speaker D. W. Thomson, who covered research and establishment of codes and standards. Continuing, he detailed the relationship between various courses given at the University of British Columbia with their use in the field. Examples cited were heat transmission, strength of materials, theory of vibration, acoustics, physiology, bacteriology, economics and English grammar and composition. In concluding his address, he spoke on facets of the profession and the future of the industry.
who's doing what . . . Noel Cripps was the first recipient of a yearly award of $300 to be presented to a selected third-year mechanical engineering student.

"A Brief Look at a Packing Plant" was given to members attending the April 12 meeting by Cliff White, Mechanical Superintendent of Burns & Company, Ltd. Of the plant's storage capacity, 4000 cu ft are maintained at 32 to 38 F and 1200 cu ft at –25 to 15 F. Used is a 320-ton ammonia refrigeration system. Steam capacity is 450 hp, with boiler steam pressure of 100 psi.

By means of slides, William H. Krack of Sporlan Valve Company showed refrigerant flow control devices made by various manufacturers and their function in a heat pump system. Mention was made of the importance of a dehydrator and its proper location in a heat pump circuit.
who's doing what . . . Frank Dwyer, Robert Butler and R. Racine have been elected to the Board of Governors.

CENTRAL ARIZONA . . . Held at the Ocotillo Power Plant of Arizona Public Service Company, the March 6 meeting was comprised of a short talk by Engineer Elmer Davies on the operation of the plant and some of its problems, followed by a tour of the facilities.

At the April 3 meeting, George Jackson reported on preparations for the Regional Meeting and presented the proposed agenda. Robert McFarland discussed the UEC Fund Drive.

Speaker for the evening was R. A. Richardson, Manager of Engineering for Tuttle & Bailey Pacific, Inc.
who's doing what . . . Proposed slate of officers for the coming year includes: President, S. A. Frederickson; Vice President, S. J. Rohats; Secretary, Robert Langmade; Treasurer, J. Cosgrove; Board Members, Paul Robinson and Ralph Thomas. J. Hoagland, C. Bodell and T. Boothroyd were appointed tellers. The Auditing Committee consists of L. A. Byron (Chairman), Robert Jett and Everett Moore.

MISSISSIPPI . . . Topic of February speaker E. Rowe of United Gas Corporation was "Use of Gas Turbines as Prime Movers for Power Generation and Air Conditioning in Buildings."

Shown at the March meeting was a film on Communism, presented by Program Chairman B. H. White.
who's doing what . . . Elected as Chapters Regional Committee Delegate and Alternate, respectively, were D. F. Ingram and L. J. Beasley.

CENTRAL NEW YORK & ROCHESTER . . . Meeting jointly on April 12, members of these two Chapters visited the Kodak Park Works of Eastman Kodak

Company. Total installed tonnage at the central plant is 21,545 ton at four temperature levels, ranging from –85 to 40 F. Installed hp is 39,000.

Following the tour, a panel consisting of J. R. McMillen of the Roll Coating Div, B. H. Vieau of the Engineering Div and L. C. Engelhart of the Utilities Div discussed operation of the plant and how refrigeration is applied in their areas of production.

who's doing what . . . Newly elected officers of Rochester Chapter are: President, Stanley Stachek; 1st Vice President, Donald A. Sweetland; 2nd Vice President, Gordon C. Boncke; Secretary, Donald D. Hinman; Treasurer, Harvey E. Siebert; Board of Governors, James D. Johnson and Bruce C. Teal. Elected to office of Central New York Chapter are: President, Edgar Galson; Vice President, Bruno Morabito; Treasurer, Donald Girard; Secretary, Theodore G. Foster; Board of Governors, John F. Smith, Robert Morgan, Robert A. Barr and Louis L. Schneider.

NIAGARA PENINSULA . . . Panel members Allan McIver, O. G. Boffatt, Bruce Hancock and Warren Goman spoke on "Base Bid vs. Open Bid" at the March 7 meeting. William McDonald was Moderator.

Laying of the trans-Atlantic telephone cable was shown at the April 4 meeting in a film presented by Mr. Prior of Bell Telephone Company.

who's doing what . . . Results of elections were: President, W. Carr; Vice President, R. Brace; Secretary, J. Kallman; Treasurer, F. Caldwell; Directors, D. McCoppen, W. McDonald, M. Murray and J. Mitchell.

CENTRAL MICHIGAN . . . "Residential Electronic Air Cleaning" was the topic of March speaker E. C. Hoefler, Regional Manager of Minneapolis-Honeywell Regulator Company. First he cited limitations of present-day air cleaning equipment, followed by a discussion of particulates in air. Three methods presented as being used in establishing air cleaner efficiency are the particle count, weight and dust spot tests.

Limiting his talk to substitution of natural gas engines in place of electric motors, April 11 speaker Frank Raufeisen, Assistant Chief Engineer, Bell & Gossett, spoke on "Gas Powered Refrigeration Units." Cited as a major problem is selection of the engine, which must have long life, simple start and low oil consumption. Suggested was use of a large capacity oil reservoir in addition to the regular crankcase capacity, which can allow for about 2000 hr of operation without addition of oil.

who's doing what . . . Suggested by the Nominating Committee as candidates for the 1960-61 season were: Roy L. Wick, President; John Jennings, 1st Vice President; James Gire, 2nd Vice President; Clifford Knudson, Treasurer; H. R. Krueger, Secretary; Richard Wright, Frank Crotser and W. M. Hassenplug, Board of Directors.

NEW YORK . . . "Air Curtains for Open Area and Entrance Heating" were discussed at the April 25 meeting by M. H. Stern, Market Manager, Industrial Div, Lennox Industries, Inc. A question and answer period followed.

Subject of the fourth of the Spring Series of Technical Seminars was "Vibration Control", covered by S. Kahn of Vibration Company and R. Batherman of Vico Company.

who's doing what . . . B. Egrin of the Tellers Committee announced the following results of the balloting for election of officers: President, Scott Spencer; Vice President, Howard Burpee; Secretary, P. A. Bourquin; Membership Secretary, J. M. Pennesi; Treasurer, Leonard Kowadlo; Board of Governors, Walter Kane, Arnold Windman, Morton Bell and J. M. Morse.

NIAGARA FRONTIER . . . R. Edwards of Edwards Engineering Corporation spoke at the March 6 meeting on "New Trends in Hydronic Heating and Cooling". Discussed were hot and chilled water installations in general, with specific emphasis on zoning, controls and fin type radiation for chilled water service.

who's doing what . . . Officer nominees are: R. Bartsch, President; H. McLaughlin, 1st Vice President; A. Worden, 2nd Vice President; R. Jorgensen, Secretary; and R. Jameson, Treasurer.

CLEVELAND . . . On April 17, a meeting of men from the Akron-Canton area was held to ascertain interest in establishing a new chapter. Regional Director James Downs was present to describe the purpose, activities and organization of the Society. A petition was prepared, applying to the national Society for establishment of the proposed chapter.

Several talks on hot water heating were presented at the regular April meeting. Lou Oswald, Public Relations Manager for the Better Heating & Cooling Council, described the work of that organization in promoting "Hydronics", with efforts directed primarily at the residential market.

Following this discussion, Sherwood Nassau of Rulton, DelaMotte, Larson, Nassau & Associates, Ron. Hotchkiss of George S. Rider Company and William Taylor of Austin Company covered high temperature water and forced hot water systems. Advantages of hot water over steam were stressed, such as simpler fittings and accessories, ease of running long distances and elimination of the problem of condensate return time.

NORTH ALABAMA . . . At the March 8 meeting, J. B. Graham, Director of Research, Buffalo Forge Company, spoke on "Evaluation of Fan Noise." Emphasis was placed on octave band ratings.

who's doing what . . . G. W. Hogan and W. L. Wayman have been nominated for the Board of Governors.

SOUTH CAROLINA . . . Region IV Director J. G. Woodroof spoke at the March 20 meeting on "Food Preservation," using slides to illustrate his talk. Application of heating and refrigeration in the food industry was cited by him as having extensive possibilities.

Covering "Textile Air Conditioning" at the

April 17 meeting, Consulting Engineer B. A. Leppard reviewed the history and development of this application. First major change, he stated, was use of the split system in 1946, a system utilizing small amounts of air supplemented with free moisture. Following this, not much was done, other than refinements such as controls, lint filters and application of vane axial fans. Developed recently was a new system consisting of a modular type unit that can be added easily to existing buildings. A slide presentation illustrated advantages of shop fabrication, standard components, flexibility, mobility and initial and operating costs comparable to presently used systems.
who's doing what . . . To serve in 1961-62 are: W. O. Blackstone, President; R. T. Waites, Jr., Vice President; R. G. Hanna, Jr., Secretary; H. R. King, Treasurer; T. O. Curlee, Jr., J. C. Harrison and B. T. Bootle, Board of Governors.

TOLEDO . . . Various systems used to remove odor were outlined by May speaker Harold Todd of W. B. Connor Engineering Corporation, "Air Recovery and Recirculation." Principal emphasis was placed on use of activated carbon in air purification.
who's doing what . . . Proposed by the Nominating Committee are: J. S. Meyer, President; R. C. Moorhead, Vice President; Dean Duston, Secretary; G. W. Bleckner, Treasurer; and N. W. Dawe, G. L. Heiser and O. Hocklin, Board of Governors.

DAYTON . . . Preceding the March 14 meeting was an informal seminar on "Refrigerant Suction Piping Design Considerations", conducted by E. T. Neubauer of Copeland Manufacturing Company, R. W. Kelto of Chrysler Airtemp and J. J. Neeson of Stanco.

Main speaker of the evening was J. W. McClain, Director of Technical Service, RBM Div of Essex Wire Corporation. Discussing "Application of Potential Type Motor Starting Relays and Controls to Refrigeration and Air Conditioning Equipment", he described typical applications of relays. Pointed out were some problems which have arisen due to changing application conditions, with suggested steps to be taken to overcome these problems. Other types of relays and contactors were covered also.
who's doing what . . . Nominated as officers for the coming season were: F. H. Doench, President; D. G. Ely, Vice President; R. E. Comstock, Secretary; D. H. Clague, Treasurer; and J. R. Hornaday and N. O. Mitchell, Board of Governors.

NORTH PIEDMONT . . . Servicing of burned out hermetic compressor installations and various uses of halogenated hydrocarbon refrigerants, including their use as a blowing agent in foam-type installations, were covered by March speakers Luther Cox of Virginia Smelting Company and S. Williams of E. I. duPont de Nemours & Company.

Problems confronting an industry moving to a new location were discussed by April speaker Everett Stevens of Carolina Power & Light Company.
who's doing what . . . Henry Chiusano (Chairman), George Rottman and Glenn Farthing have been appointed to a committee to present plans for an annual award to be made to a member having made significant contributions to the Society. Proposed for office in the coming year were: R. Funderburk, President; G. Farthing, Vice President; S. Blount, Secretary; T. French, Treasurer; D. Bean and J. Swaim, Board of Governors.

PITTSBURGH . . . Sales factors were discussed by March speaker Joseph R. Oliver of Joseph R. Oliver Associates, covering both psychological and practical aspects of the subject.

Films, demonstrations and a guided tour were combined to familiarize members attending the April 17 meeting with the Atomic Energy–Duquesne Light and Westinghouse installation at Shippingsport, Pa.
who's doing what . . . Nominating Committee Chairman Charles Schneider presented the following slate of officers: President, G. E. Smetak; 1st Vice President, A. S. Estatico; 2nd Vice President, H. Shratter; Secretary, D. B. Hicks; Treasurer, J. H. Llewellyn; and Board of Governors, K. M. Newcum and R. M. Toucey.

ILLINOIS-IOWA . . . Lauren Seeley, ASHRAE Presidential Member and Chief Engineer, H. B. Smith Company, spoke at the April 17 meeting on C. I. boilers and heat generation equipment. Under ASME code requirements, maximum steam and water pressure allowed are 15 and 160 psi, respectively. Hydrostatic test pressures have to be twice the working pressure on 30-psi boilers and two and a half times the working pressure on boilers operating under higher pressures.

Three methods of assembling C. I. boilers were cited: gaskets, push nipples and pipe nipples and headers. Effect of thermal shock is minimized by yoking the return line into both sides of the boiler. Speaker Seeley suggested that C. I. boilers not be drained during the summer.
who's doing what . . . Officers for the coming year are: D. G. Johnson, President; M. L. Smith, Vice President; P. J. Hannon, Secretary; J. A. Sandberg, Treasurer; and J. P. Benbow, Jr., and J. R. Lewis, Board of Governors.

OTTAWA VALLEY . . . Attending the March 21 meeting was Regional Director D. L. Angus. The two student winners of the Chapter's annual award, John Buchan and John Roll, were presented with their prizes by Professor Bowes of Carleton University.

Operation of the bi-metallic steam trap was detailed by D. Tomelty of Velan Engineering, Ltd. Also touched on were lack of suitable standards for steam trap sizing and methods of determining trap capacities.

ONTARIO . . . "Practical Applications of Heat Pumps" were discussed at the April 11 meeting by A. F. Johnson of York Div, Borg-Warner Corporation. Beginning with basic definitions, he went on to speak of features and advantages of heat pumps. Slides showed various installations.

Committee reports were featured at the May 1 meeting, summarizing activities of the past season.

Speaking were Chapter President L. N. Adams, W. Rootham of the Membership Committee, M. Bennett of the Papers Committee, E. Coles of the Special Events Committee, C. Torry of the Constitution and By-laws Committee, G. Batanoff of the Attendance Committee, R. Brown of the Greeters Committee, J. Coutts of the Fellowship and Accommodation Committee and M. Bowman, who gave the Secretary's and Treasurer's reports.

Reporting on Chapter elections, J. Jenkinson announced that E. Fox is President and members of the Board of Governors are: J. Coates, W. Mould, M. Bowman, E. Okins, G. Toms, G. Granik, W. Woodcock, D. Ledgett, C. Roth and J. Parker.

NORTHERN ALBERTA . . . John Gattenmeyer, of Caproco Ltd., presented a study of problems of corrosion at the March 15 meeting. Seven methods used to reduce corrosion were listed and discussed. In addition, a demonstration with various metals used as anode and cathode showed expected results.
who's doing what . . . A Nominating Committee consisting of J. McBride, W. Sinclair, V. Carroll, H. Wiber, H. Bristow and W. Woods was appointed to prepare a slate of officers for the April meeting.

Speaking April 19, J. Robertson discussed the Boiler and Pressure Vessel Act.
who's doing what . . . Suggested slate of officers includes: President, R. Proudfoot; Vice President, H. Hole; Secretary, A. Nordstrom; Treasurer, H. Bristow; Board of Governors, A. Stix, V. Carroll, E. Pantell, H. Fisher, A. McCallum and H. Wiber.

GOLDEN GATE . . . Preceding a tour of the Kaiser Office Building, members attending the April 6 meeting heard a resume on details of the building, presented by architect Robert Fisher and William Cockins, mechanical contractor. Techniques used in installation of the mechanical system were described.
who's doing what . . . Officer nominees are: R. C. Pribuss, President; D. A. Delaney, Vice President; L. E. Dwyer, Secretary; J. D. Kniveton, Treasurer; and T. E. Brewer, G. L. Gendler and Karl Guttman, Board of Governors. C. E. McLaughlin, William Moon and J. C. Beck, Jr., comprise the Tellers' Committee to count the ballots.

IOWA . . . April speaker David Anderson of Offutt Air Force Base, Omaha, Nebr., presented a discussion and film on "Operation of the Strategic Air Command."

SAN DIEGO . . . A resume of the ASHRAE Chicago meeting was given at the March 14 session by Region X Director T. J. White. An announcement was made of the Regional Meeting to be held in Phoenix.

Guest speaker was John Morse of Carrier Air Conditioning Company. His subject was "Air, Water and Evaporative Condensing in Air Conditioning."
who's doing what . . . Certificates of Appreciation were presented to K. N. Flocke and H. A. Smith. S. A. Bayne and H. A. Smith are Regional Committee delegates.

"Refrigerant Piping and Piping Problems in Modern Refrigeration Systems" was discussed by April speaker C. Otterholm, Mechanical Engineer, Richard Dawson Company.
who's doing what . . . Elected for the 1961-62 term were: M. Jackson, President; W. Neild, Vice President; C. Deilgat, Secretary; C. Butcher, Treasurer; S. Bayne, D. Butala and K. Klein, Board of Governors. Regional Committee Representative and Alternate, respectively, are W. Neild and R. Townsend.

Spring Regional Meetings Held in Shreveport, El Paso and Phoenix

During April, ASHRAE delegates and alternates from 27 chapters attended three spring Chapters Regional Committee Meetings in Shreveport, La., El Paso, Texas, and Phoenix, Ariz. Thirteen states and Canada's Province of British Columbia were represented at these meetings, which were conducted by Regions VIII, IX and X.

Two of the meetings, those at Shreveport and Phoenix, were coupled with Regional Conferences, during which interesting technical presentations were made by specially invited speakers.

Although discussions of chapter progress and problems played an important part at these meetings, the basic business consisted of the election of a member and an alternate to the Society's Nominating Committee; recommendations for regional directors; recommendation of candidates for national officers and directors-at-large; recommendation of members for general and technical advisory committees; and the extending of invitations for 1961-62 Chapters Regional Committee Meetings.

Analyzed at the meetings were Chapter By-laws, attendance at meetings, programs, speakers, how to attract new members, rosters, publications and communications. Featured at all meetings was a report from Headquarters by John H. Fox, ASHRAE Second Vice President and Chairman of the Regions Central Committee. Vice President Fox reported on the growth of the Society since the merger two years ago, the Society's progress in improving its publications and analyzing its Research Program and the need for better communications between Headquarters and chapters and between chapters and individual members.

Most essential, he stated, is the determination by each member to contribute his support and special skills to enable the Society to move continually forward and to advance still further the arts and sciences of our profession.

Among the headquarters staff members who attended were F. W. Hofmann, Assistant Secretary–Membership, and J. H. Cansdale, Assistant Secretary–Public Relations and Fund Raising. At each meeting, Secretary Cansdale discussed the progress of the chapters in their fund raising campaigns for the United Engineering Center. Currently, 25 of the 27 chapters in these three regions have organized campaigns and appointed chairmen; one chap-

El Paso – Snapped during the Region IX meeting are, clockwise, J. N. Eichers and C. E. Warren, Utah Chapter; L. D. Niblack and H. R. Deming, Rocky Mountain Chapter; J. H. Brooks and G. H. Jackson, El Paso; F. W. Hofmann – ASHRAE Assistant Secretary – Membership; Fred Janssen, Region IX Director; John H. Fox, ASHRAE Second Vice President; J. H. Cansdale – ASHRAE Assistant Secretary – Public Relations and Fund Raising; W. Stevens, New Mexico; F. W. Osborn, Wichita; J. W. Thompson and R. J. Scott, Nebraska; D. D. Paxton, New Mexico; and Harry Wortman, El Paso Chapter

ter – Central Oklahoma – has achieved its quota; $7,442.40 has been raised towards the chapters' combined goal of $54,270.00.

The first of the spring meetings was held on April 21 and 22 in Shreveport, conducted by William J. Collins, Director of Region VIII. This meeting was coupled with a Regional Conference, highlighted by four technical presentations and a banquet attended by delegates, guests, Shreveport Chapter members and their wives. The technical talks were by R. L. Sinclair, Chemist, United Gas Corporation, Carthage, Texas – "Corrosion Problems Experienced in Heating and Cooling Systems"; Neil Hill, Sorey-Hill and Sorey, Architects and Engineers, Oklahoma City, Oklahoma – "Heat Pump Reclaim Systems"; I. E. Rowe, United Gas Corporation, Shreveport, La. – "Recent Developments in AGA Laboratory"; and M. J. Wilson, Director of Market Development, Carrier Corporation – "Environment for Learning." Director Wilson's talk was followed by a panel discussion on school air conditioning by Eugene Fleming, III, of Shreveport, representing the architect; D. Dana Price of Houston, Texas, on behalf of the engineer; L. L. Waite of Shreveport for the school board; and M. J. Wilson, representing the manufacturer.

A novel and interesting topic on the two-day agenda was the Chapter Officer Workshop, with various delegates discussing the roles and responsibilities of the various chapter officers.

The Region IX meeting was held on April 24 in El Paso, conducted by Regional Director Fred Janssen. In addition to the spirited and enthusiastic business program, delegates and guests were invited to a banquet and dance in old Juarez, Mexico.

Among guests who attended the Region X meeting on April 28 and 29 in Phoenix were two Presidential Members of the Society, Arthur J. Hess and Daniel D. Wile. Regional Director Thomas J. White presided over this session, which also was coupled with a Regional Conference. Technical papers were presented by C. S. Perkins, Head of Mechanical Department, A. C. Martin and Associates, Los Angeles – "Air Conditioning, Spring and Fall – Consideration of Varying and Reversing Loads"; Ralph Elsea, Manager of Systems Engineering, Carrier Corporation, Syracuse, N. Y. – "Control Systems for Varying Reversing Loads"; Clay T. Snider, Commercial Regional Sales Manager, Minneapolis-Honeywell Regulator Co., Minneapolis – "Fan Coil and Induction Units"; V. R. Baird, Application Engineer, Powers Regulator Company, Skokie, Ill. – "Multizone and Double Duct Units"; and Hugh V. Alexander, District Engineer of Dallas office, Johnson Service Company, Milwaukee – "Outside, Return and Exhaust Air." Also on the agenda was a general forum with L. A. Nally, President of Clark & Co., Inc., Tucson, as Moderator.

Speaker at the luncheon was Carl A. Sauer, president of the American Institute for Foreign Trade, Phoenix.

Shreveport – Officers, hosts and guests pose for the camera during the Region VIII Chapters Regional Committee Meeting. In the usual order are W. J. Collins, Director of Region VIII; P. N. Vinther, Dallas Chapter; Richard L. Johnson, General Chairman of the Committee on Arrangements, Shreveport chapter; John H. Fox, ASHRAE Second Vice President; John S. Tarlton, Secretary, Shreveport chapter; and John J. Guth, President, Shreveport Chapter

Meetings ahead

June 11-14—American Society of Mechanical Engineers, Summer Annual Meeting, Los Angeles, Calif.

June 11-15—54th Annual Meeting, Air Pollution Control Association, New York, N. Y.

June 12-15—National District Heating Association, 52nd Annual Meeting, Portsmouth, N. H.

June 12-15 — Institute of Boiler and Radiator Manufacturers, Annual Meeting, Absecon, N. J.

June 25-30 — American Society for Testing Materials, Annual Meeting, Atlantic City, N. J.

June 26-28 — American Society of Heating, Refrigerating and Air Conditioning Engineers, 68th Annual Meeting, Denver, Colo.

August 15-17—Cryogenic Engineering Conference, University of Michigan, Ann Arbor, Mich.

August 21-31 — International Exhibition of New Sources of Energy, Rome, Italy.

August 23-26—International Institute of Refrigeration, Commission 5, Budapest, Hungary.

August 28-September 1—International Heat Transfer Conference, sponsored by the American Society of Mechanical Engineers and the American Institute of Chemical Engineers, Boulder, Colo.

October 2-4—American Gas Association, Annual Convention, Dallas, Texas.

October 23-27—National Metal Exposition, Detroit, Mich.

October 31-November 2—Fourth Canadian Refrigeration and Air Conditioning Show, Toronto, Ont.

November 5-7—National Frozen Food Association, National Convention and Exposition, Bal Harbour, Fla.

November 6-10—National Warm Air Heating and Air Conditioning Association, 48th Annual Convention, Chicago, Ill.

November 12-15 — Air Conditioning and Refrigeration Institute, Annual Meeting, Hot Springs, Va.

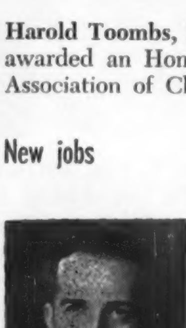
News of ASHRAE members

Honors and Recognitions

Grant Joseph Hayes, of Hayes Brothers, Inc., is the 1961 recipient of the Distinguished Service Award of the Mechanical Contractors Association of America, Inc. The award, in the form of a commemorative scroll, was presented at the Association's Annual Convention, held May 9-12. Citing various committee activities of Mr. Hayes, the scroll was awarded "in recognition of his outstanding service to the industry and in sincere appreciation of his many years of unselfish and valued work."

Harold Toombs, Head Engineer of the Conrad Hilton Hotel in Chicago, was awarded an Honorary Membership in the Practical Refrigerating Engineers Association of Chicago. The presentation was made on April 29.

New jobs



William F. Kerka, Research Engineer at the ASHRAE Laboratory, has accepted the post of Assistant Dean of Engineering at Fenn College in Cleveland, which he will assume the latter part of this month. Recipient of a B.M.E. from Fenn in 1948, he was associated with H. K. Ferguson Company in 1946-47 and Babcock & Wilcox Company in 1949. Graduate studies were pursued at Case Institute of Technology, where he worked on the Air Distribution Cooperative Research Program. His M.S. was received in 1952, and in that same year he joined the staff of Oregon State College as an instructor. He has been with the Laboratory since 1954.

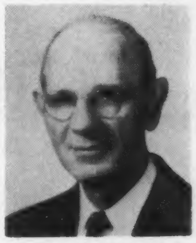
William H. Roberts, formerly Development Manager of Central Equipment for Carrier Air Conditioning Company, has been named General Product Manager at York Div, Borg-Warner Corporation. Joining Carrier in 1953, he served as Research and Application Engineer, Senior Development Engineer and Manager of Systems Engineering before becoming Development Manager. Prior to that, he was Assistant Professor of Mechanical Engineering at New York University and Instructor of Mechanical Engineering at Northwestern Technological Institute. He is co-author of a reference book, "Modern Air Conditioning, Heating and Ventilating."

J. E. Kumler, former Chief Engineer of Ranco, Inc., is now Vice President – Research and Engineering. Since joining the organization in 1940 he has served in various capacities, among them design engineer and factory manager. Also elevated was **J. H. Manecke**, from General Sales Manager to Vice President – Sales.

J. Paul Jones, in his new post as Vice President of Engineering and Manufacturing, H. W. Tuttle & Company, will be responsible for development and manufacture of all products of the company. Director of Research and Development for Whirlpool Corporation since 1954, he has served also as Director of Engineering with Bendix Home Appliances, Inc., and as Chief Engineer and Production Manager for Libby Div, International Detrola Corporation. He is a graduate of the University of Illinois.

Ilse M. Jahn, Administrative Assistant at the ASHRAE Research Laboratory, will undertake a teaching career, following closing of the Laboratory. Starting in September, she will be Head of the German Department at Shaw High School in East Cleveland, Ohio.

Retirements



Alfred J. Ferretti, Chairman, Department of Mechanical Engineering, and Professor of Mechanical Engineering, Northeastern University, is retiring on June 30 after 43 years of service. A graduate of Massachusetts Institute of Technology, he was appointed to the Northeastern University faculty in 1918, after serving as an assistant instructor at MIT. In addition to ASHRAE, he is a member of the American Society for Engineering Education, American Association for the Advancement of Science, Engineering Council for Professional Development, Massachusetts Society of Professional Engineers, Engineerneering Societies of New England, American Society for Testing Materials and American Society of Mechanical Engineers.

Necrology

William Hamilton Bateman, deceased, was born in 1894. An Associate Member since 1944, he had been a partner in Keystone Sales Company.

John M. Staveley died recently at the age of 67. Educated at Tufts College (B.S. 1916), he joined the Society in 1956.

Kornelius Siemens, Consulting Engineer, was 38 at the time of his recent death. He had been a Member since 1956.

Edward D. Martens died March 16. Vice President of Starret Brothers & Eken, Inc., he joined the Society in 1937.

James Posey of James Posey and Associates, a Life Member of ASHRAE, who joined in 1919, died on March 28 at the age of 84. He had worked as a consulting engineer since formation of the firm of Painter & Posey in 1910, and was a Fellow of the American Society of Mechanical Engineers.

E. G. Rowledge had been General Manager of Pressed Steel Company, Oxford, England, until his death on May 19.

Presidential Member

Alpheus Beede Stickney

1903-1961

Past-President of precedent American Society of Refrigerating Engineers Alpheus Beede Stickney died on April 17, 1961. Born in St. Paul, Minn., on July 1, 1903, he was the son of Charles Alpheus and Edith Pierpont (Jones) Stickney. Educated at Yale University, he received his B.S. in 1923 (cum laude), M.S. in 1924 and M.E. in 1932.

Active in the Society since election to membership in 1932, he spoke at several national meetings, was the author of numerous technical articles which appeared in REFRIGERATING ENGINEERING, was Associate Editor of the DATA BOOK and author of various DATA BOOK Chapters, and was ASRE Representative on ASA Committee B31, Code for Pressure Piping. Committee memberships include Standards (1941-43), Executive (1942-45), Nominating (1945-46), Relations with Other Organizations (1945-46, Chairman) and Publications (1946). Membership on Council from 1934-41 was followed by election to Vice President in 1942-43 and President in 1944.

Others are saying—

central air conditioning systems . . . for apartment buildings can be classified as dual duct, all-air; three-pipe, perimeter induction fan-coil; single duct with reheat coils; two-pipe, perimeter induction or fan-coil; through-the-wall fan-coil units; or recirculating-type fan-coil units, fresh air from interior ducts. Greatest potential for flexibility of control is offered by the first three cited; however, dual duct and single duct with reheat require the most space for ductwork and are more expensive to install. Until recently, the most commonly installed type of system has been the through-the-wall fan-coil unit with perimeter vertical pipe distribution. The induction system, which uses a combination of air and water to furnish heating and cooling, with a high degree of temperature and humidity control, has become quite popular for large apartment buildings. *Architectural Record, March 1961, p 216.*

ice bank air conditioning . . . stores up cooling capacity when air conditioning is not needed, then delivers it when there is a demand, suiting this method for applications requiring high peak air conditioning capacity for relatively short periods of time at intermittent intervals. Comprising the system is a series of refrigeration coils, usually of the plate type, immersed in water in an insulated tank. A compressor hooked to these coils in a conventional refrigeration cycle makes ice form on the coil surfaces. When cooling is called for, a pump circulates the chilled water in the tank over the ice bank and then through pipes to the finned coils in the air handling units. After picking up heat from the air, the water returns to the tank to be rechilled and recirculated as needed. *Refrigeration & Air Conditioning Business, May 1961, p 36.*

Robert J. Evans is Senior Engineer for the ARI, not Chief Engineer as reported in the May JOURNAL.

Candidates for ASHRAE Membership

Following is a list of 121 candidates for membership or advancement in membership grade. Members are requested to assume their full share of responsibility in the acceptance of these candidates for membership by advising the Executive Secretary on or before June 30, 1961 of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted by the Board of Directors.

Note: * Advancement † Reinstatement

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HECKLER, F. W., JR., Sales Engr., Heckler Bros., Pittsburgh.

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They Wanted to Know

B-9 CODE INTERPRETATION
To ASHRAE:

In the B-9 Safety Code the following sentence appears: "The ventilation shall consist of windows or doors opening to the outer air, of the size shown in Table 5, or of mechanical means capable of removing the air from the room in accordance with Table 5."

We would appreciate an interpretation as to the intent of the Code in relation to the windows and doors. Are these windows and doors to be open all of the time, or, are they windows and doors that can be opened in the event of a refrigerant leak of any type? We do not usually think of an equipment room door being left open all of the time, nor would windows be left open at all times.

G. C.

Paragraph 8.11.2 in B-9 Code says "means for ventilation" and "mechanical means capable of". No, the doors and windows need not be open, only capable of being opened.

The fan runs only when necessary (except see 8.11.4) as in case of a refrigerant leak. We would suggest that you consult Section 6 to establish when a machinery room is required.

USE OF REFLECTIVE INSULATION
To ASHRAE:

Seeking to determine the best insulation for use in the walls of my house, I encountered a problem in the use of reflective insulation. Considering the winter heat flow in a wall consisting of 2 in. of rockwool, two sides reflective insulation, air spaces and a non-reflective face which would be sheathing, I am leaving a ¾-in. air space in front of the aluminum faced insulation and a ⅞-in. air space facing the sheathing (this would be behind the foil insulation). Using the 1959 ASHRAE GUIDE I obtained an "R" value of 1.02 for the ⅞-in. non-reflective air space. Information from an insulation company about the "R" value of their material showed this space with an "R" value of 3.52, considering the space to be reflective.

As the heat flow faces a non-reflective surface, should not the "R" value of 1.02 be used?

G. H.

The value reported to you by the insulation company is correct. Since there is a reflective surface binding both air spaces on each side of the rock wool, each space has a thermal resistance of 3.52 when the temperature difference is 10 F. This temperature difference is approximately correct for the construction you describe.

WHO'S WHO IN ASHRAE

Insofar as possible these listings will each appear twice a year

ASHRAE OFFICERS, DIRECTORS COMMITTEES, STAFF

See page 94, this issue

REGION AND CHAPTER OFFICERS

See page 80, March JOURNAL

RESEARCH AND TECHNICAL COMMITTEES

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STANDARDS PROJECTS

See page 88, May JOURNAL

INTER SOCIETY COMMITTEES

See page 84, November JOURNAL

EFFECT OF DUST ON REFLECTIVE INSULATION
To ASHRAE:

In answer to a query in the December issue of the JOURNAL you state that dust has a negligible effect on thermal value of reflective insulation. Since over a period of several years a heavy deposit of dust can build up on the aluminum foil surface when the material is installed in the ceiling, we think that this must have considerable effect upon the emissivity of that surface.

As manufacturers of reflective insulation we frequently encounter this problem, but have not, as yet, found any definite scientific information on the matter. Have any tests been made, or are there any now in progress, that will clarify this subject?

I. D.
Homebush, Australia

Not until recently has the effect of dust particles on reflective insulation been seriously investigated. In an investigation conducted by one manufacturer it was found that dust has no effect on foil surfaces when used in the vertical position in walls or in floor spaces where dust cannot accumulate. There was found to be no effect within air spaces. There was a significant effect on the top surface facing the ventilated attic air space.

Reflectivity values of this top uppermost surface in attics appeared to be dependent upon a number of factors. Reflectivity near the ventilators was the most affected. Areas within the air stream from one ventilator to another appeared to be affected more than other relatively remote areas. Geographical location appeared to have some effect; houses located on dirt roads were more affected than those situated on paved streets.

From these tests it was not possible to arrive at an integrated value for the reflectivity drop due to dust particles, but it is thought that this value would fall close to a 20 or 25% reduction of reflectivity. This reduction would take ten or more years to be realized.

The cost of a comprehensive investigation of this problem is almost prohibitive.

At the air-cooled condensing Seminar of the Philadelphia Chapter, Chairman was Otto J. Nussbaum (speaking). Carl J. Forve served as Moderator and introduced Speakers Ralph W. Geltz, Clifford J. Kimmel, John J. Seelaus, Dan E. Kramer and Ralph B. Tilney (shown in the usual order).

Air Cooled Condensing is Topic of Philadelphia Seminar

OTTO J. NUSSBAUM

In keeping with the purposes of this Society, to promote the arts and sciences of heating, refrigeration, and air conditioning, the Philadelphia Chapter has established a tradition of conducting Seminars open to all interested individuals. These are conducted in a non-technical fashion and are intended mainly to provide educational and practical information to service engineers, wholesalers, sales engineers and others who wish to refresh their knowledge of basic fundamentals of the art.

Air-cooled condensing became the most recent topic and was covered from view points including that of the contractor, maintenance engineer, equipment designer, compressor and coil manufacturer and control system designer.

The Technical Committee of the Philadelphia Chapter secured the qualified speakers. An administrative group handled meeting arrangements and ticket sales. Their activities included advance printing and distribution of 2000 tickets; the printing and placement of 100 posters in wholesalers', contractors' and manufacturers' offices; publicizing of the event in local trade magazines and commercial publications; engaging a photographer; arrangements with the management of the meeting hall concerning seating, public address system, luncheon arrangements, coat room arrangement. The price of admission to the Seminar was established after all arrangements were completed and the costs to the Society were known. Attendance at the Seminar was in excess of 200 and the auditorium was filled completely.

The meeting was welcomed by Ludwig Mack, Philadelphia Chapter President, and Chairman of the Technical Committee, Otto Nussbaum, outlined the rules under which the Seminar would be conducted and invited questions from the panel members and from the audience at the end of each presentation.

Most recent in its series of Seminars, this meeting of the Philadelphia Chapter follows that on air conditioning (JOURNAL, October 1960) and heating (JOURNAL, January 1961). There are two of these each year. The basic concept on which they are based was stated by Walter Spiegel (October 1960).

Moderator, Carl J. Forve, a Past President of the Philadelphia Chapter, first introduced speaker Ralph W. Geltz, District Engineer for York Corp., who discussed air-cooled and evaporative condensers and compared their relative merits, explaining the air temperature rise with air-cooled condensers and with evaporative condensers and the air quantities required per ton of refrigeration with each method. He reviewed design considerations, construction and various arrangements available, such as draw-through, blow through, centrifugal or propeller fan and horizontal or vertical air flow units. He discussed also such considerations as the location of equipment room, ambient temperature in equipment room, outdoor air temperature, freezing weather operation, operating noise level, permissible compression ratio, relationship of cooling load in winter vs. summer and piping problems. Problems of winter operation with evaporative condensers, including head pressure control by the use of a two-speed fan with or without thermostatically controlled dampers in the condenser air stream, were covered, too.

Second speaker was Clifford J. Kimmel, Product Manager for Brunner Heat-X, whose topic was the effect of air-cooled condensers on compressor behavior. He cited the problem of discharge gas temperature and stated that the permissible limit of this temperature should be 270 F as, above this temperature, lubricating oil tends to vaporize, oxidize and disintegrate, thus leading to sludge formation, discharge valve failures, and, in the case of hermetic compressors, eventual

Otto J. Nussbaum is Chief Engineer, Kramer-Trenton Company and Chairman of the Technical Committee of the Philadelphia Chapter.

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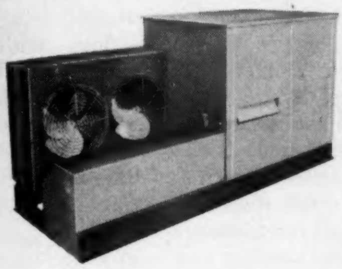

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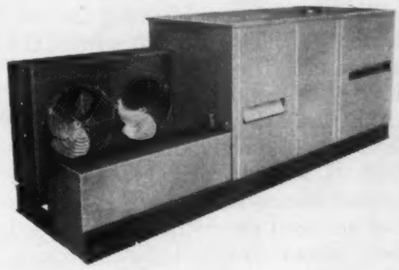

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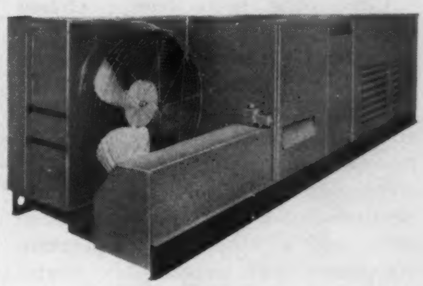

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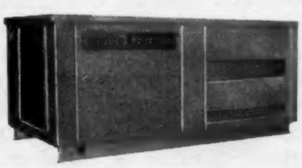

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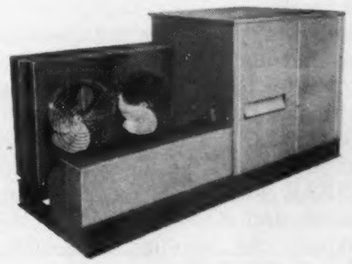

E

A **cooling only**
5 hp, 7½ hp, 10 hp, 20 hp

B **combination cooling & heating**
gas fired
5 hp, 7½ hp, 10 hp, 20 hp

C **combination cooling & heating**
oil fired
5 hp, 7½ hp, 10 hp

D **heating only**
75,000 BTU/hr thru 250,000 BTU/hr

E **combination cooling & heating**
steam, hot water, electric heating coil
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All of the above are available with various electrical characteristics

All of the above are available for duct application

Only a complete line can offer flexibility and economy in meeting your specific heating and cooling requirements. And Melco Roof-Top is a complete line. Now you can specify units with Individual Thermostats or with Central Control Panels. Now you can specify Central Control Panels for individual unit operation or for simultaneous operation of entire system. And you can specify them with or without Filter Change Indicator.

The Melco Roof-Top has many exclusive features . . . features that are a direct development of five years of pioneer experience in roof mounted air conditioning. Molded fiberglass inner and outer ducts sheathed in aluminum and factory insulated diffuser mean no field insulating . . . no vapor sealing . . . no condensation. Telescoping counterflashing assembly provides finest type of roof seal and eliminates the need of fabricating expensive custom made parts to connect unit and curbing. Three-point suspension of molded fiberglass duct and factory insulated diffuser mean fast, easy installation. And Melco's casing of aluminized steel eliminates rust and thus costly maintenance.

These are just some of the reasons why, during the last five years, Melco Roof-Top has been continually specified and used on industrial plants, shopping centers, bowling alleys, chain stores, restaurants, banks and offices.

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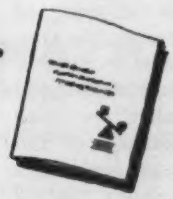

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breakdown of the motor insulation and consequent burnout. Speaker Kimmel stated suction gas superheat to be especially critical in hermetic compressors where further superheat is added when the gas passes through the motor windings. He recommended insulation of the suction lines, liquid injection from the receiver into the suction line through an expansion valve sensing discharge temperatures, downgrading of heat exchangers to provide a minimum of superheat and relatively little subcooling.

Condensing units having chassis mounted-air-cooled condensers may have the condenser sized according to horsepower and regardless of the evaporating temperature level and compressor displacement, thus the same condenser may serve a 3-hp compressor at high evaporating temperature but with a low compression ratio; and a 3-hp low temperature compressor with considerably greater displacement and lower compression ratio. This design policy ensures comparatively low condensing temperatures when the compression ratio is higher, and tends to keep discharge gas temperatures down.

Dan E. Kramer of the Kramer Trenton Co. was the third speaker; his investigations of head pressure control problems have appeared in the past in the JOURNAL. Speaker Kramer reminded that with properly sized air-cooled condensers, control of head pressure and receiver pressure is not a problem during the warm season. During the winter, two distinct problems exist, specifically, "On-Cycle" and "Off-Cycle" problems. On-cycle problems are insufficient expansion valve feeding at times of low receiver pressure and failure of hot gas systems to defrost at times of low head pressure. Off-cycle problems were recognized to be the failure of the compressor to start when the receiver pressure is not sufficiently high to actuate the low pressure switch, short cycling after startup due to liquid flashing ahead of the expansion valve and failures of pressure actuated defrost termination controls.

Those various methods used to solve the on-cycle problems include two distinct approaches, namely, air side control and refrigerant side control. Air side control consists of stopping or modulating air flow through the condenser either by step-wise cycling of the fans or by the use of multi-speed fan motors, all controlled by head pressure. The shortcomings of fan control are fluctuation of both high side and low side pressure, liquid flashing and loss of control at high wind velocities. As a better means of air side control there was cited the outdoor modulating damper, actuated by a modulating head pressure control. This damper can be either of the bypass, shut-off or mixing type. Its controls are recognized as inherently costly; outdoor dampers are subject to operating problems, especially in areas of heavy snowfall.

Refrigerant side controls are essentially methods of reducing the effective condenser surface by partially filling the condenser with liquid refrigerant to inactivate it as required. The flooding can be accomplished by heating the receiver either directly or by heating the liquid leaving the condenser, to inhibit drainage from the condenser. The heat can be supplied directly by condensing discharge gas in the cold liquid entering the receiver or indirectly through the medium of a heat exchanger. Speaker Kramer compared the various controls that are used presently and discussed their advantages and disadvantages. He emphasized the main prerequisite of a good refrigerant side control, which is to provide sufficient receiver pressure regardless of outdoor ambient temperature and without a substantial pressure drop between the condenser and receiver.

Following the morning presentations and discussions the meeting adjourned for lunch, where the Seminar chairman, the moderator, and the panelists had an opportunity to exchange views at the lunch table with ASHRAE First Vice President John Everetts, Jr.

When the session reassembled. Ralph B. Tilney, Director of Research for the Alco Valve Co., reviewed evaporator control in air cooled condensing systems, referring first the relatively high condensing pressures and liquid line pressures to be expected in such systems and recommended the use of solenoid valves having a high opening pressure differential. Liquid line driers used in such systems must have high bursting strength and have the ability to retain moisture at elevated liquid temperatures, he stated. As to thermostatic expansion valves, these must be capable of operating at a wide range of inlet pressures without hunting. Expansion valve feeler bulbs must respond rapidly to changing conditions so as to eliminate starved evaporators, or conversely prevent liquid flood-back and damage to the compressor upon startup.

To evaluate the sensitivity of a feeler bulb, speaker Tilney would record changes in bulb temperature as a function of time when a change in refrigerant temperature takes place. Expansion valves which provide a 63% response can yield a 6.3 deg change in bulb temperature within a few sec in response to a change of 10 F in refrigerant temperature. Liquid-charged and gas-charged thermostatic expansion valves, when used in conjunction with air-cooled condensers, due to the greater mass of fluid involved, will show that a liquid charge responds more slowly to changing conditions than a gas charge. However, with outdoor systems, gas charged expansion valves heretofore lost control when ambient temperature at the valve diaphragm was lower than the bulb temperature. New types of gas charges have been developed that do not suffer from this condition, yet offer the quick response required with air-cooled condensers.

RETIRING PRESIDENT TULL SPEAKS TO ASHRAE MEMBERS. PAGE 66

Last speaker was John J. Seelaus of Air Conditioning Associates, who reported air-cooled condenser maintenance and installation experiences. He proposed that the installer anticipate system capacity at maximum design conditions, taking into account the compressor capacity to be expected at possible high condensing temperatures. His experience indicates that first cost of air-cooled systems is approximately 10% higher than that of conventional evaporative cooled systems; while air-cooled operating cost is considerably lower than for conventional systems of equal capacity. Rigging costs were cited as lower than with conventional systems due to the relatively light weight of air-cooled condensers.

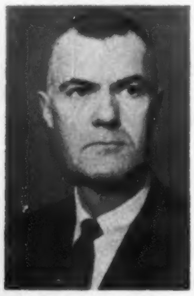
In planning installations, it was recommended that attention be given to the possible danger of short circuiting of air to the condenser intake and disturbance of the neighborhood created by air noise. Considerable improvements are possible by directing the air discharge upwards or away from zones of human occupation. Head winds were not emphasized as a problem with air-cooled condensers because of the cone shaped air discharge pattern of propeller fans.

As for condenser maintenance. speaker Seelaus conceded, this is a minor problem from the contractor's viewpoint in comparison with those of other condensing methods. He called attention to the need for dust removal in unusually dirty atmospheres. He has found that a draw-through condenser is less affected by dust because the dust is distributed evenly over the face of the coil. With blow-through condensers he has observed concentrated dust accumulation in spots.

FORUMS

(*Continued from page 65*)

Tunnels vs. Burial of Heating, Air Conditioning and Utility Lines



PAUL F. CUMMINGS
Member ASHRAE
Architectural and Engineering Div.
Minnesota State Dept. of Administration

This Forum will be concerned with the relative merits of tunnels vs. direct burial of heating, cooling and utility lines. Advances in the fields of metals technology, corrosion control, cathodic protection, durability of insulation. welding, expansion compensation and other developments which contribute to the present state of the art of direct burial of piping will be explored. Consideration will be given to first cost, accessibility, maintenance, ventilation, drainage requirements and other factors influencing the long term economical selection of tunnels, conduits or direct burial for underground systems.

Introducing and Controlling Humidity in Heated Living Spaces

A. G. WILSON
Member ASHRAE
Head
Building Services Section
Division of Building Research
National Research Council of Canada

Residential heating systems have undergone continual development and improvement in the past several decades. It is now possible to provide uniformly controlled temperature conditions throughout the living space at reasonable cost. There has not been a corresponding development in providing means of controlling relative humidity. This may have been partly because relative humidity is of lesser importance in relation to comfort and partly because of the problems of introducing or removing moisture from the space to maintain humidity at the appropriate level. Considerable attention has been given to the problems associated with excessive humidities in houses. Similarly, there is an awareness of the undesirable effects of excessive dryness on comfort and on moisture sensitive furnishings.

It is intended at this Forum to discuss the desirable limits of relative humidity, both maximum and minimum, in heated living spaces; the range of humidities that occurs in various kinds of dwellings; and the amounts of moisture that it may be desirable to add or remove. It is hoped that the discussion will also bring out information on the kinds of equipment available for humidification, their advantages and limitations, and some new approaches to controlling humidity within the desirable range.

ASHRAE Research Status

E. P. PALMATIER
Member ASHRAE
Chairman
ASHRAE R & T Committee
Carrier Research and
Development Co.

This Forum will have three purposes: (1) To present the annual report of the Research and Technical Committee; (2) to present the final draft of the R&T organization, which will go into effect on July 1; and (3) to stimulate ideas for 1961-62 research projects and initiate committee activity to formulate project details.

Industrial Heat Recovery

JOHN H. CLARKE
Member ASHRAE
Visking Company

Heating, air tempering and air conditioning loads in the modern industrial plant have become excessive. Many plants are completely air conditioned. In others the make-up air requirements may exceed five million cfm. Operating costs alone for such systems may go beyond a half million dollars annually. In addition, requirements for the initial equipment may be quite expensive. It is of great importance that equipment and operating costs be kept to a minimum by all practical means of heat recovery and conservation.

A number of methods is available for this purpose for air conditioning and cooling installations: (1) Improve the building design. Insulate, vapor proof, reduce infiltration and reduce glass areas. (2) Improve process and equipment design to reduce heat release. Insulate hot equipment and piping. (3) Recirculate air whenever possible. Filter and purify as necessary, and where permitted. (4) Reduce make-up air requirements by careful design of hoods and other equipment requiring air. Bring uncooled air directly to the hoods and processes requiring make-up air. Use air from adjoining cooled spaces for make-up. Downgrade the air. (5) Operate for economy. Keep the outside air to the systems to the minimum. Shut down when possible.

For heating and make-up air tempering: (1) Reduce the make-up air requirements by careful design of hoods and other equipment requiring air. Whenever possible, bring in raw air directly to the hoods or process requiring the air. (2) Mix the supply air with hot building air. (3) Pass the supply air through a heat exchanger to recover process, equipment or engine heat. Exchangers may be hot air to air, hot gas to air or hot liquid to air. (4) Heat the air by cooling process or other equipment. (5) Recirculate air whenever possible. Filter and purify where practical and where permitted. Downgrade the air; use from adjacent areas whenever possible. (6) Operate for economy. Keep the supply air and the supply air temperatures to the minimum. Shut the systems down whenever it is safe and practical to do so.

Rule of thumb engineering has no place in the design of modern plants. The time spent on sound engineering will return dividends in economy.

Integration of Lighting and Air Conditioning

W. F. SPIEGEL
Member ASHRAE
Charles S. Leopold, Inc.

The advent of increased lighting intensities and new architectural treatment of ceilings has focused attention on the manner of handling the resultant high loads and air quantities.

In many cases it is no longer practical to consider lighting and air conditioning application factors separately, design objectives could be achieved more satisfactorily by consideration of the combined problem.

Under discussion will be various methods of integrating lighting and air conditioning design, including the use of lighting fixtures having supply or return air provisions, water cooled luminaires, eggcrate, suspended and luminous ceiling systems, plenum arrangements, basic principles, dirt and air patterns, utilization of building thermal storage and other problems.

Internal Motor Protectors for Hermetic Refrigerator Compressors

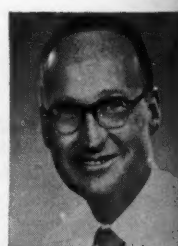
JOSEPH KUMLER
Member ASHRAE
Vice President
Research & Engineering
Ranco Incorporated

This will be an informal presentation by and of several manufacturers' approaches to internal motor protectors for hermetic refrigeration compressors.

Hermetic compressors on heat pumps, remote system cooling units, commercial refrigeration units, etc., are subjected to many conditions that make it difficult for protectors to offer complete motor protection. The industry trend and intense interest is on internal motor protectors. There are many basic different approaches to internal motor protection and there are many people working on the problem at this time.

It is considered that now is a good time to offer a rather complete but informal review and discussion of the whole subject of internal motor protection.

Problems of High Altitude Installations

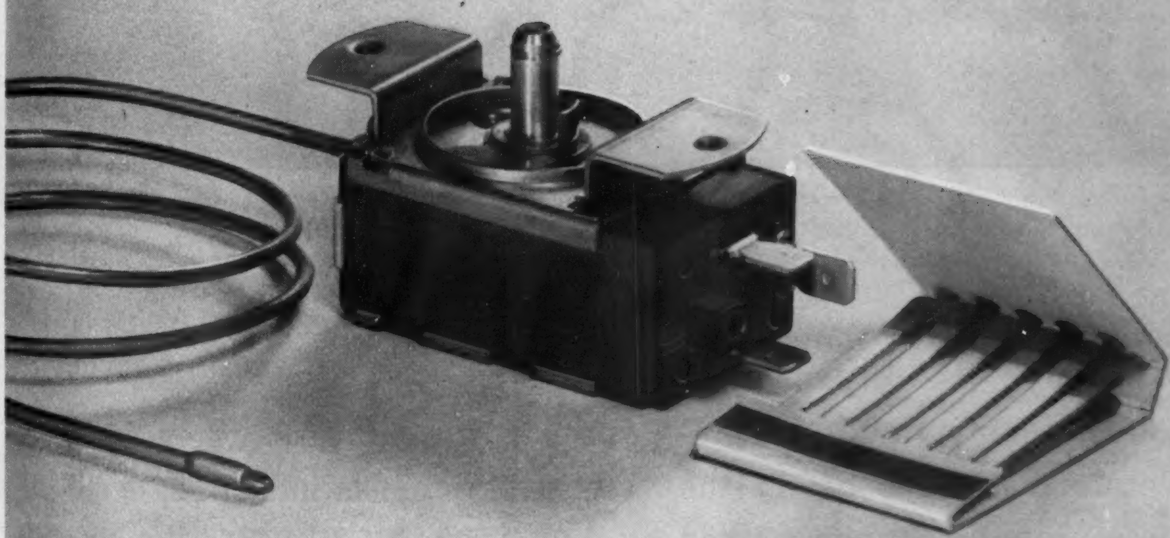


D. D. PAXTON
Member ASHRAE
Vice President
Bridgers and Paxton

The purpose of this Forum is to attempt to arrive at uniform methods of correcting equipment capacities for high altitude operation. This will cover, in general, the following types of equipment: (a) fans; (b) cooling and heating coils; (c) radiation; (d) air cooled condensers; (e) gas and oil fired boilers and furnaces; (f) cooling towers and evaporative condensers; (g) air distribution systems; (h) air compressors.

Additionally, the need for standard published high altitude psychrometric charts in the design of heating, ventilating and air conditioning systems will be emphasized.

Finally, the need for an adequate testing laboratory to determine performance characteristics of equipment at high altitudes will be pointed out.



WHICH HEAT PUMP SYSTEM IS BEST FOR YOUR REQUIREMENTS?

Air to air, air to water, water to air or water to water ...Carrier has all the components to meet the exact needs of any commercial, industrial or institutional application!

Which is the best system for your requirements? That depends on the heat source, air or water, and method selected for inside distribution.

Because it is available everywhere in unlimited amounts, outside air is the most popular source of heat. When other sources are unpredictable, an air source system is usually best. It's usually best, too, when a building or factory has exhaust air which can be used advantageously. Conversely, if water from well, surface or process is available, at a proper temperature, then a water source system is indicated.

Inside considerations: If the inside system employs direct expansion units for air treating such as shopping centers, stores, schools, churches, etc., then the type of heat pump system indicated is air to air or water to air. On the other hand, the inside system may use water as the cooling and heating fluid to various air treating assemblies such as under-window fan coil units. In those cases, particularly in multi-room

BULLETINS

Pipe Protection. Designed to protect and cover insulated pipe ells, preventing cracking of insulation due to pipe expansion and contraction, aluminum ell jacketing is the subject of a flyer. Thirteen sizes are offered to cover ells from 3 through 12.81 in. OD.
General Aluminum Supply Company, 1515 Eastern Ave., Kansas City 26, Missouri.

Portable Indicator. Descriptive of the Minimite, a portable potentiometer indicator, four-page Catalog 64-1 has been revised. Included are specifications, application information, accessories and photographs illustrating relative size, construction details and maintenance. Also covered is a special adaptation, the Airline Minimite.
Thermo Electric Company, Inc., Saddle Brook, N. J.

Stainless Steel Enclosures. Flyer GEA-7324 describes stainless steel Nema IV enclosures for watertight applications of manual and magnetic motor starters. Illustrated are enclosures available for starters up to 200 hp, 600 volt. Other photographs show construction features.
General Electric Company, One River Rd., Schenectady 5, N. Y.

Valves and Accessories. Semi-steel valves and accessories are described and illustrated in revised 44-page Bulletin V-203. Specifications and dimensions are given for all sizes of semi-steel straightway, steel jacketed, multiport and special order valves. Accessories include wrenches, locking devices, extensions, lubricants and the new Hypregun for lubricating valves.
Rockwell Manufacturing Company, Nordstrom Valve Div, 390 N. Lexington Ave., Pittsburgh 8, Pa.

Heat Exchangers. Featuring removable bundles with floating clamp-ring design, C-500 heat exchangers are the subject of Flyer 451. Discussed are applications, engineering specifications and features of these units, which are fabricated from standard pre-engineered components combined into custom-built assemblies with 19 shell sizes from 6 through 42 in. and in any practical tube length.
American-Standard, Industrial Div, Detroit 32, Mich.

Air Diffuser. Providing extensive information on an air diffuser for troffers, eight-page Catalog CLD-70 con-

tains selection and performance data, discusses typical ceiling applications and details installation. Permitted by the CLD diffuser is coordination of air distribution and lighting in a single ceiling unit.
Anemostat Corporation of America, 10 E. 39th St., New York 16, N. Y.

Infra-Red Burners. Infra-Line, gas-fired, infra-red burners are designed for low temperature commercial and industrial process heating. Units are manufactured in 6 x 12-in. sections and are available with end or bottom-flanged inlets. Full rated capacity for each section is 30,000 Btu/hr. Dimensional drawings and detailed specifications are presented for the burners and accessories (such as manual and electrically ignited atmospheric and blast pilots, pilot-mounting brackets and divider plates), in four-page Bulletin H-19. Suggestions for applying the burners, a list of typical uses and extensive selection and sizing information are included.
Eclipse Fuel Engineering Company, Rockford, Ill.

Adjustable Pressure Switches. For use in fluid systems operating at up to 250 psi, Deltadyne leak-proof, adjustable pressure and differential pressure switches are described in Flyer E8. Included are photographs and drawings of the switch, together with a description of its construction and operation, optional variations and available accessories. Units covered are adjustable within the differential pressure range of 0.125 to 16 psi.
Pall Corporation, 30 Sea Cliff Ave., Glen Cove, N. Y.

Time Controls. Outlining features of the D-Frost-O-Matic line of time controls for electric heat and compression shut-down defrosting, four-page Bulletin 5949 provides general specifications, mounting dimensions and wiring diagrams.
Paragon Electric Company, Inc., Two Rivers, Wisc.

Pressure-Temperature Ratings. Including standard ratings for materials used in steel valves of the 300 to 2500-psi pressure classes, a quick reference chart has been designed to be hung on the wall or placed under a glass desk top. Bulletin 593.
Edward Valves, Inc., a subsidiary of Rockwell Manufacturing Company, East Chicago, Ind.

Pipe and Sheet Insulation. Ultra-Foam, a flexible formed plastics pipe covering that provides thermal and vapor barrier protection, is discussed

in four-page Bulletin A-1-5-61. Advantages are detailed, properties are tabulated and photographs illustrate applications.
Gustin-Bacon Manufacturing Company, 210 W. 10th St., Kansas City, Missouri.

Plastics Pipe. Contained in 26-page "The Story of Plastics Pipe" is a review of technology, applications and codes, intended as a guide in development of codes for plastics pipe. Listed on the contents page are: acrylonitrile-butadiene-styrene (ABS), cellulose acetate butyrate, polyethylene, polyvinyl chloride (PVC), water and sewage systems, water services and commercial standards and test methods.
Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.

Centrifugal Roof Ventilator. Discussing and illustrating design features and operating characteristics of CRD direct-drive ventilators, eight-page Bulletin 4104 provides a hypothetical set of typical specifications as a guide to engineers when ordering equipment. Selection and rating tables indicate relative quietness ratings, motor hp, fan speeds and fan deliveries for different static pressure conditions. Simplified installation-type drawings are correlated with tabular data to provide important dimensions for use in engineering and architectural layouts.
American-Standard, Industrial Div, Detroit 32, Mich.

Meter Swivels and Nuts. Offset, adapter and straight meter swivels and meter nuts are pictured in Flyer 300-2. Three typical installations also are illustrated. Features of the units are discussed.
Eclipse Fuel Engineering Company, Gas Service Products Div, Rockford, Illinois.

Aluminum Door Louvers. To C/S standard and sight-proof models have been added an operating door unit, a light-proof louver and a sound absorbing louver. Units are available in a wide range of sizes and free areas and are fabricated from extruded louver sections, 6063-T5 alloy, minimum 16 gauge. Descriptive, engineering and specification data are presented in a four-page bulletin.
Construction Specialties, Inc., 55 Winans Ave., Cranford, N. J.

Air Cleaner. Extensive information on operation of the low resistance, Model C Type P Cycloil, industrial

(*Continued on page* 115)

BULLETINS

(*Continued from page* 110)

oil bath air cleaner is contained in eight-page Bulletin 160-C. Detailed drawings illustrate component parts, their construction and action. Dimension drawings and capacity and resistance curve graphs, as well as instructions for installation of the Cycloil also are included. The unit is used to clean intake air to engines, compressors and blowers and is suited especially for applications where atmospheric dust conditions are most severe.
American Air Filter Company, Inc., 215 Central Ave., Louisville 8, Ky.

Valve Attenuators. Requiring neither motors nor mechanical linkage, Series 45P Pneumavalve Total Constant Volume High Velocity Valve Attenuators are described in four-page Bulletin K-52. Featured are DPC ceiling and DPW under-window units. Sizes, capacities, selection and performance data, dimensions and ratings are detailed for each and control information is provided.
Connor Engineering Corporation, Danbury, Conn.

Room Coolers. Now manufactured in six basic capacities, these draft-free units are offered for use as meat-cutting and packaging room coolers. Flyer MCR 731.01 is designed to aid selection by means of an outline of two selection methods, each detailed by tables. Diagrammatic sketches of the unit key to construction, motor hp, coil, filter and distributor component data.
Drayer-Hanson Div, Hi-Press Air Conditioning of America, Inc., 3301 Medford St., Los Angeles 63, Calif.

Strip Heaters. Descriptions, illustrations and selection procedures for this line of general purpose and finned-type strip heaters are provided in twelve-page Catalog C-300. Units are suitable for use in outdoor control equipment and forced hot air, radiant and baseboard heating. Covered in the bulletin are high and low temperature ratings, wattages, voltages and dimensions for units with both terminals at one end and for those with one terminal at each end.
Bryant Electric Company, Box D, Barnum Station, Bridgeport 2, Conn.

Externally Adjustable Switches. For the range from 15 to 200 psid, Deltadyne pressure and differential pressure switches are designed to open or close an electrical circuit when pressure, differential pressure or flow become excessively high or low. Units can withstand system pressures to 5000 psi. Flyer E9 gives technical data on construction and operation of these lightweight switches and contains photographs and drawings illustrating the actuating mechanisms. Optional accessories, pressure and temperature ranges and fluid service are covered.
Pall Corporation, 30 Sea Cliff Ave., Glen Cove, N. Y.

Side-Fired Boilers. Specifications listed in four-page Bulletin 140 are for 6, 12, 15, 20 and 30-hp, oil, gas or combination gas and oil-fired boilers, 100 or 125-psi working pressure. Boilers are of a side-fired design cited as combining the corrosion-resistant advantages of a horizontal boiler, in which firetubes are immersed in water, with the low floor space requirements of a vertical unit.
Lookout Boiler & Manufacturing Company, Chattanooga 5, Tenn.

Solar Protection. Manufactured by assembling a piece of louvered shade screen between two pieces of glass, Glare-X, when used in windows and glass walls, is cited as providing control of solar heat and glare. Four flyers discuss features of this product, efficiency, construction and specifications.
Tyre Bros. Glass Company, 3008 S. San Pedro St., Los Angeles 54, Calif.

Hermetic Burnout. For checking degree of contamination in a burned-out system, a simple field test is outlined in this twelve-page bulletin, together with a short-cut procedure for cleaning out mildly contaminated systems by using pressurized cylinders of Refrigerant 11 solvent to flush the unit. These procedures are applicable to situations where no moisture remains in the system other than that formed by breakdown of the motor insulation or oil.
Allied Chemical Corporation, General Chemical Div, 40 Rector St., New York 6, N. Y.

Flowmeters. Two new models of the turbine flowmeter (a propeller-type flowmeter that transduces liquid velocity to a millivolt signal) are described in six-page Specification 10C1505. These meters can be installed in any attitude directly in the pipeline and have an accuracy of $\pm 0.5\%$ of flow rate over a broad flow range. Meter sizes run from ½ to 24 in. Materials of construction,

performance characteristics, dimensional drawings and capacities are cited.

Described in an auxiliary bulletin, eight-page Specification 51-2860, are six new transistorized totalizers and batch controllers designed for use with these turbine meters.
Fischer & Porter Company, 852 Jacksonville Rd., Warminster, Pa.

1961 Air Conditioners. Descriptive of the Unitaire Line is 12-page Catalog AC201. Detailed is how a face and by-pass damper control keeps both temperature and air circulation constant, with a single damper blade directing the flow of air either through or around the coils as desired. A graphic selection method of matching units to installation requirements simplifies sizing.
Airtherm Manufacturing Company, P. O. Box 7039, St. Louis 77, Mo.

RESEARCH PAGE

(*Continued from page* 78)

for presentation before the Society. Some had already been active in doing this. This report would not be complete without special reference to the quite fine work done by the coordinators of the eight Technical Committee groups. They have worked hard to assist in establishing the new Committee pattern and generally have done an excellent job of promoting a sound program of technical activities.

While the further reorganization of the Technical Committee structure which is pending inevitably will create some additional difficulties, there is every reason to believe that great improvement will result. There is strong support from the membership for the combining of research and technical activities in a single group of Committees. Technical Committees have already been asked to begin to formulate research projects to be carried out at cooperating institutions.

The regrouping of Committees to conform more closely to natural divisions of member interests within the Society will provide a much better basis for catering to these interest areas. Direct representation of these Committee Groups on the Research and Technical Committee will facilitate communication and promises to provide a much improved basis for coordination of research and technical activities. There is every reason for optimism that Technical Committee activities which have been developing despite many difficulties will be greatly aided by the pending changes and will be enabled to grow rapidly.

job, but
us over the rough spots"

ARCHITECTS: *Perkins & Will, Chicago*
CONSULTING ENGINEER: *E. R. Gritschke Assoc., Chicago*
MECHANICAL CONTRACTOR: *Economy Plumbing Co., Niles, Ill.*

At Pure Oil's new home, individual temperature control in over 400 rooms is maintained and constantly supervised by a Honeywell Selectographic DataCenter*.

"This new Pure Oil Building has one of the most intricate temperature control systems we've ever seen," says Mr. Ross. "In fact, there are more individual controls than in 99% of the systems built today." Mr. Ross adds: "We counted on Honeywell for accurate scheduling and over-all supervision of the installation—and they came through! Honeywell always had enough engineers and technicians on the job to keep everything rolling smoothly. It's very reassuring to know Honeywell's on your team."

The Honeywell Selectographic DataCenter controls temperatures for the entire Pure Oil Building. It also includes control over a building-wide security system and fire alarm system. Because the fire alarm system is hooked up to the local fire department, one of Honeywell's many jobs was to indoctrinate the Palatine Fire Department on the Selectographic and the new fire alarm system.

With 76 years experience in temperature control you can depend on Honeywell quality and service. Fine controls, accurate specifications, prompt delivery and expertly supervised installations are assured with Honeywell on your team. And only Honeywell designs and manufactures all three types of control systems—pneumatic, electric and electronic. For further information, call your nearby Honeywell Office. Or write Honeywell, Dept. AH-6-126, Minneapolis 8, Minn.

*Trademark

Fred Heiden, Utility Operator for the Pure Oil Building, seated at the Selectographic DataCenter.

Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Applications

ROOF TOP UNIT HEATS AND COOLS BOATHOUSE

In winter months a Curtis ten-ton combination unit, mounted on the roof of an annex of a multi-quonset structure on Lake Erie, circulates air at a comfortable level throughout the eight rooms of the two-story building. In previous summers, the air in the interior was hot and humid; this is now compensated for by the cooling cycle of the unit. Additional utility is obtained by means of an air distribution hose and coupling connection that conditions boats tied up at the inside or outside docks.

FREEZING PROCESS PRODUCES FRESH WATER FROM SALT

Utilizing a freezing process system, the salt water conversion plant at St. Petersburg, Fla., produces ice crystals, which are fresh water, by pumping salt water and liquid butane into either a Melter-Washer Tower or a rotating basket device. As the butane turns to a gas, it draws heat from the salt water, creating a slurry of ice in the brine. Next, the brine is drained from the slurry and the ice crystals washed clear of any remaining salt water. The ice then moves to a unit where the heat throw-off from butane gas under pressure causes it to melt. Potable water is sent to storage tanks and the brine returned to the bay. Expected is daily production of 35,000 gal.

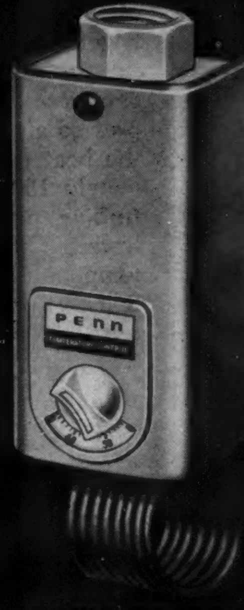
Used to insulate piping and equipment is Foamglas, a cellular glass insulation produced by Pittsburgh Corning Corporation. A high-strength glass foam consisting of millions of sealed cells, it is unaffected by most acids and solvents and is impervious to moisture. Two layers of insulation were used with two coats of an asphalt cut-back reinforced with glass fabric for the finish coat.

GAS TURBINE ENGINE TESTING AIDED BY PORTABLE CONDITIONER

Inlet temperatures for gas turbine engines during development and performance tests at Garrett Corporation's AiResearch Manufacturing Div in Phoenix, Ariz., must be maintained at 60 F, even when outside summer temperature may be as high as 110 F. Designed to solve this temperature control problem was a portable air conditioner.

Comprising the cart-mounted unit is an AiResearch air-driven cooling turbine assembly in combination with American-Standard equipment: a packaged motor-fan unit, chilled water coil and an air-to-water, shell-and-tube heat exchanger. The system is divided into two sections, the first consisting of the fan assembly and coil unit and producing 90-F air, the second

Series 219 without external range adjustment.



Series 219 space thermostat with range adjustment knob and integral air bulb.

Series 219 with external range adjustment.

LOOK WHAT'S NEW IN REFRIGERATION TEMPERATURE CONTROLS

Series 239 has both external range and differential adjustment.

Now! Compact size, highly accurate repeat performance, plus other new sales features!

Here's a new line of small, compact, Penn refrigeration temperature controls which has a *wider range* of applications with *fewer models.* The Series 219 has a fixed differential while the Series 239 differential is adjustable. Rated at 16 Amps., these models feature extremely close differential, precision "repeat" accuracy, and are not affected by barometric pressure or cross ambient temperature problems. Extra features include built-in conduit fitting on Series 219, visible linear scale and small bulb size. Closed-tank fittings and bulb wells as well as built-in compensation for ambient temperature are also available. Learn more about these controls . . . write for Bulletin 3270.

PENN CONTROLS, INC. Goshen, Indiana

EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

of the compressor, turbine and heat exchanger. Refrigerated plant air at 70 F is ducted into the compressor section of the cooling turbine, where it is compressed, resulting in a temperature increase. Compressed air, at approximately 340 F, is ducted through the heat exchanger, which cools the air to approximately 130 F. When the air is passed through the turbine portion of the equipment, it is expanded, lowering its temperature to –65 F. When this low temperature air is mixed with the 90-F air from the first section, the result is the required 60-F inlet air temperature for turbine testing.

PRE-ASSEMBLED FAN-COIL UNITS SPEED INSTALLATION

Approximately 90% of the exterior walls of the new office building of Libbey-Owens-Ford Glass Company in Toledo, Ohio, are glass, 77% of the gross area being Thermopane insulating glass. Connecting spandrels are heat tempered Vitrolux. Each side of the building is a zone served by an American-Standard high pressure conditioner supplying air to induction units under the windows. Serving the core area of the building are two more conditioners, for a total of six. Contained in these units are integral cooling coils which use water chilled by a pair of 600-ton units located in the basement. Installation time for the system was reduced by use of units containing pre-assembled fan and coils, thus eliminating on-the-job placement of components and large amounts of sheet metal work formerly required.

SNOW MELTING SYSTEM

Access ramp and parking area for the newly constructed Marshall & Ilslev Auto Bank in Milwaukee, Wisc., have an automatic system that melts snow as it falls. Used for the combination grid and sinuous coil system were 17,000 ft of ¾-in. diam Byers 4-D wrought iron pipe. Prefabricated, the pipe was taken to the job site, spaced on 12-in. centers and embedded in an 8-in. concrete slab. Hot water, mixed with 50% ethylene glycol, is circulated through the pipe system. Water temperature fluctuates between 120 and 140 F. Capacity of the system is 510 gpm.

LIGHTING SYSTEM SUPPLIES HEAT FOR TEN-STORY BUILDING

Main feature of the modernization program for the ten-story headquarters building of Rochester Gas and Electric Corporation involves integration of the lighting, heating and air conditioning systems. When completed, the building will have lighting levels at 200 foot-candle, air conditioning on the second through tenth floors and much of the heating requirement supplied by the lighting system.

Because of the availability of ample steam capacity, an absorption-type York refrigeration plant was selected. It is located in the penthouse, resulting in minimum condenser and chilled-water piping and

pumping costs. Under-window induction units with large coil capacity are served from a three-pipe system, which provides hot or chilled water as required. Installed capacity of the system is 760 ton.

Sufficient heat in winter is provided by the lighting system for all except peripheral areas. To reduce excessive heat in internal areas, a high pressure, dual-duct air system is provided, with individual mixing boxes for each office or zone and diffusers located level with the ceiling.

THREE HEAT PUMPS TO SERVE EIGHT-STORY RESEARCH CENTER

Built by Carrier Air Conditioning Company, three large capacity, electrically powered refrigerating machines will be installed in Allen-Bradley Company's new headquarters and research center in Milwaukee, Wisc. Used in summer to provide chilled water for cooling the eight-story structure, the same machines will remove excess heat from interior spaces in winter to warm areas next to outside walls. Enough extra heat is generated by people, lights and machines in the interior area to warm the whole building and provide a surplus for nights, weekends and holidays. Excess heat will be stored in water in two 75,000-gal tanks. In operation, the heat pump system will have a cooling capacity of 1400 ton.

SEVENTEEN MILES OF PIPE USED TO HEAT AND COOL AIRPORT

Heating and cooling systems for the new Atlanta, Ga., air terminal required seventeen miles of carbon steel pipe, supplied by Tube Turns Div of Chemetron Corporation. Used for cooling are three 1000-ton refrigeration units; heat is provided by a high temperature, high pressure hot water system which operates between 350 and 400 F and at pressures up to 450 psi. The all-welded piping system utilizes six-in. diam pipe with walls almost ½ in. thick to handle hot water under these conditions.

OUTSIDE AIR SOURCE HEAT PUMP HAS 280-TON COOLING CAPACITY

In operation at Masland Duraleather Company's new plant in Mocksville, N. C., a Carrier heat pump using outside air as a source of heat in winter consists of two electrically-driven centrifugal chillers, with cooling capacities of 200 and 80 ton, respectively. In summer, the larger machine removes heat from interior spaces and transfers it to the outside through a cooling tower. In winter the cycle is reversed. Heat from cold outside air will be extracted as the air is drawn through a large coil containing antifreeze. Heat from a process load obtained by the smaller chiller will supplement the winter heating system.

During the plant's two-shift operation, conditions of 80 F and 50% relative humidity in summer and 72 F in winter will be maintained. Heat and cold will be transported in a closed water-piping circuit between the heat pump and conditioning equipment.